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ANNUAL REPORT OF THE ADMINISTRATOR
OF THE ENVIRONMENTAL PROTECTION AGENCY
TO THE
CONGRESS OF THE UNITED STATES
IN COMPLIANCE WITH
SECTION 313, [illegible]
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THE CLEAN AIR ACT, AS AMENDED

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16. ABSTRACT

The report addresses the progress made in the prevention and control of air pollution in 1986. It covers the areas of air quality trends and monitoring, developing of air quality criteria and standards, the status of State implementation plans, the control of stationary and mobile source emissions, enforcement, and litigation. The report is the annual report of the Administrator of EPA to the Congress in compliance with Sections 313, 202(b)(4), and 306 of the Clean Air Act, as amended.

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OF
42 U.S.C. 7401 ET SEQ.
THE CLEAN AIR ACT, AS AMENDED

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Radiation
Office of Air Quality Planning and Standards
Research Triangle Park, NC 27711

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PREFACE

The Clean Air Act, as amended, authorizes a national program of air pollution research, regulation, and enforcement activities. This program is directed at the Federal level by the U.S. Environmental Protection Agency (EPA). However, primary responsibility for the prevention and control of air pollution continues to rest with State and local governments. The EPA's role is to conduct research and development programs, set national standards and regulations, provide technical and financial assistance to the States, and, where necessary, supplement State implementation programs.

Section 313 of the Clean Air Act requires the Administrator to report on measures taken toward implementing the purpose and intent of the Act. This report covers the period January 1 to December 31, 198~~8~~7 and describes the issues involved in the prevention and control of air pollution and the major elements of progress toward that goal that have been made during that time. In addition, this report also includes two other EPA reports to Congress required under the Clean Air Act, as amended:

1. Section 306 report on Federal procurement and violating facilities (Chapter VIII); and,

2. Section 202(b)(4) report on measures taken in relation to motor vehicle emissions control (Chapter IX).

I. INTRODUCTION AND SUMMARY

A. INTRODUCTION

This report, which has been prepared in order to satisfy the requirements of sections 313, 202(b)(4), and 306 of the Clean Air Act (Act), describes the progress that the Environmental Protection Agency (EPA) has made in the prevention and control of air pollution during calendar year 1987. The following paragraphs summarize the contents of the remaining chapters of this report, especially insofar as those chapters illuminate current understanding of air quality problems, controls, and administrative apparatus.

B. AIR QUALITY TRENDS, MONITORING, AND MODELING

(Since it takes approximately 1 year to assemble, analyze, and report air quality and emissions data on a national basis, the latest air quality and emissions data available for this report are for the year 1986.)

All of the criteria pollutants showed improvements in air quality and emissions between 1977 and 1986. Specific details on air quality and emissions levels, for each of the pollutants to which national ambient air quality standards (NAAQS) applied in 1986, are as follows:

- Annual average ambient total suspended particulate (TSP) levels decreased 23 percent between 1977 and 1986, while TSP emissions decreased 25 percent. Between 1985 and 1986, ambient TSP levels were unchanged, while TSP emissions declined 3 percent. On July 1, 1987, EPA promulgated new standards for particles nominally 10 micrometers and smaller in diameter (PM_{10}), rather than TSP. PM_{10} monitoring networks are now being deployed nationally.

- Annual average ambient sulfur dioxide levels decreased 37 percent between 1977 and 1986, while total sulfur oxide emissions decreased 21 percent. Between 1985 and 1986, ambient sulfur dioxide levels declined 3 percent, while total sulfur oxide emissions declined 2 percent.

- Ambient carbon monoxide levels decreased 32 percent between 1977 and 1986, while total carbon monoxide emissions decreased 26 percent. Ambient carbon monoxide levels were basically unchanged between 1985 and 1986. The long term progress reflects the continuing reductions in carbon monoxide emissions brought about by the Federal Motor Vehicle Control Program.

- Annual average ambient nitrogen dioxide levels decreased 14 percent between 1977 and 1986. During this time, total nitrogen oxide emissions decreased by 8 percent, and highway vehicle emissions, the source category likely impacting the majority of nitrogen dioxide monitoring sites, decreased by 13 percent. Between 1985 and 1986, ambient nitrogen dioxide levels were unchanged, while total nitrogen oxide emissions decreased 2 percent.

- The composite average of the second highest daily maximum 1-hour ambient ozone values decreased 21 percent between 1977 and 1986, while volatile organic compound (VOC) emissions decreased 19 percent. The decrease in ambient ozone levels is complicated by the change in the ozone calibration procedure that occurred in the 1978-79 time period. In the post-calibration period (1979-1986), ambient ozone levels decreased 13 percent, while VOC emissions decreased 20 percent. The ozone trend in the 1980's shows that the 1980 and 1983 values were higher than those in 1981, 1982, 1984, 1985, and 1986. While 1986 levels are similar to 1985 levels, there was a slight improvement of 2 percent in the national composite average between these 2 years.

- Ambient lead levels decreased 87 percent between 1977 and 1986, while lead emissions decreased 94 percent. Between 1985 and 1986, ambient lead levels declined 35 percent, while lead emissions declined 59 percent. This extremely large decrease in both air quality levels and estimated emissions is largely due to the reduction of the lead content of leaded gasoline.

The EPA promulgated regulations in 1979 which required States to establish and operate air monitoring networks and to report the data to EPA. Two types of permanent stations are provided for in the regulations - State and Local Air Monitoring Stations (SLAMS) and National Air Monitoring Stations (NAMS). The SLAMS, which were designed to meet the overall monitoring requirements of State implementation plan activities, were required to meet all provisions of the regulations by January 1, 1983. Through December 1987, 4742 SLAMS monitors were operating in accordance with the requirements of the regulations. The NAMS, which are a subset of the SLAMS network, are designed to provide a national monitoring network as required by section 319 of the Act. Through December 1987, 1255 NAMS monitors were operating in accordance with the requirements of the regulations.

To accompany the revisions to the national ambient air quality standard for particulate matter, EPA, on July 1, 1987, also promulgated amendments to 40 CFR 58 (Air Quality Surveillance and Reporting Regulations). The revisions to Part 58 established ambient air quality monitoring requirements for PM_{10} as measured by a new reference method promulgated as Appendix J of 40 CFR Part 50 or an equivalent method. Specialized training was provided by EPA to State and local agency personnel on the operation and maintenance of the PM_{10} samplers. Also, in addition to using funds supplied by EPA, the States and local agencies have separately purchased PM_{10} samplers bringing the total number of operating PM_{10} samplers to 884 at 583 sites as of December 31, 1987.

Ambient hydrocarbon data were collected at 32 sites in 1987 in order to measure nonmethane organic compounds in various cities. Results from this activity will be used in estimating the amount of source control needed to attain the ozone air quality standard.

During 1987 efforts to improve guidance on air quality models and to ensure consistency in their use continued. An air quality model clearinghouse was maintained to ensure that use of nonguideline techniques does not lead to inconsistent regulatory decisions. Regulatory action to update the "Guidance on Air Quality Models (Revised)" continued with a notice of final rulemaking scheduled to take place in 1988. Also during 1987, EPA continued to provide technical support and review of ozone model applications using the Empirical Kinetics Modeling Approach (EKMA). The EKMA computer program was upgraded and several draft documents describing how to apply EKMA underwent public comment.

During 1987, EPA continued work on receptor models by finalizing the "Chemical Mass Balance (CMB) User's Manual." Operation of the CMB program was described, along with further guidance on validating CMB applications and reconciling differences between receptor and dispersion model results. Also in the air quality modeling area, in June 1987 EPA published the document "Onsite Meteorological Program Guidance for Regulatory Modeling Applications." This report provides EPA's guidance on the collection and use of on-site meteorological data intended for use in regulatory modeling applications.

Efforts continued during 1987 to strengthen EPA's capabilities for modeling potential releases of toxic chemicals into the atmosphere. A refined model for the elevated, high-momentum release of heavier-than-air gases (such as might occur in the operation of a pressure relief safety valve) was developed under contract and is currently being assessed. Development of a model for estimating airborne concentrations from mechanical draft cooling towers was completed in 1987, and the model is currently being used to assess the impact of chromium emissions from such towers. In addition, a major effort undertaken in 1987 involved the application of integrated air emission and dispersion models to facilities that treat, store and dispose of hazardous wastes. These models were used to estimate ambient concentrations of a large number of potentially hazardous substances emitted from the facilities.

Also in 1987, EPA published major revisions to emission factors for use by States and others to estimate source emissions and to compile emission inventories. Nearly all of these revisions involve additions of size-specific emission factors, with emphasis on PM_{10}, for use in implementing the new PM_{10} ambient air quality standard promulgated in 1987.

C. AIR POLLUTION RESEARCH PROGRAMS

The EPA conducted a number of research activities in 1987 to support various air pollution control programs. Research was conducted to support the development and review of national ambient air quality standards, to develop new source performance standards and State implementation plans, and to support regulations for hazardous air pollutants. Research was also conducted to support the EPA mobile source regulatory program, the indoor air pollution program, the stratospheric ozone program, and the Agency's global warming program. Considerable research was also conducted by EPA in 1987 in the area of acid deposition.

In the area of research support to the national ambient air quality standards process, EPA began work on the revision of the criteria documents for carbon monoxide (CO) and oxides of nitrogen (NO_x). An issue paper on the health effects of acid aerosols was drafted and peer reviewed in June 1987. A nonmethane organic compound (NMOC) monitoring project was carried out during the summer of 1987 to assist States in meeting current ozone national ambient air quality standards and to provide data needed by the agency in considering revisions to the ozone air quality standards. In 1987, capabilities of EPA and the State and local agencies to assess the performance of PM_{10} dichotomous samplers and continuous nitrogen dioxide (NO_2) monitors was sharply improved by development of audit materials for dichotomous flow and NO_2 monitors. Clinical studies of human exposures to ozone were conducted in 1987 and several questions were answered about the effects of criteria pollutants on asthmatics. In addition, EPA continued to perform research on the potential neurotoxicity of lead. In 1987, eight journal articles, two proceedings, and one in-house report were published which described various results of the National Crop Loss Assessment Network research program. In addition, EPA performed a number of research activities related to visibility protection in 1987.

The EPA performed a number of research activities in 1987 to support the development of new source performance standards and State implementation plans. A new contract was awarded to apply reburning, a fuel staging combustion modification technology, to a coal-fired, cyclone utility boiler. Based on previous bench- and pilot-scale tests, a NO_x reduction of 50 percent or greater is expected. An in-house research project resulted in the design of a heavy oil low NO_x burner with advantages over previous designs. Development of a low-cost process for sulfur dioxide (SO_2) control continued in 1987 as part of EPA's advanced flue gas desulfurization (FGD) program. An improved chemical reaction mechanism was developed to quantify the atmospheric formation of ozone from its precursors. This mechanism will provide an alternate approach to the carbon bond mechanism currently used in some ozone air quality models to develop cost-effective ozone control strategies. A computer model which quantitatively describes the formation and removal of ambient particulate matter was developed. A new tracer technique was applied to estimate source strengths of pollutant emissions which are normally inaccessible with conventional techniques. Two procedures for sampling stationary source emissions of PM_{10} were evaluated in field tests.

Numerous research activities related to the development of regulations for hazardous air pollutants were conducted in 1987. The health assessment document for chromium was updated through the completion of an issue paper which describes the health effects of substitutes for chromium in cooling towers. New health assessment documents were published for beryllium, acrolein, acetaldehyde, chlorine/hydrogen chloride, and phosgene. New techniques for the classification and identification of toxic and potentially toxic organic pollutants from gas chromatographic-mass spectrometric monitoring data were developed and tested. The development, evaluation, and validation of source test methods to support the regulatory process included studies of methods for a number of organic compounds, including acrylonitrile, butadiene, carbon tetrachloride, chloroform, dioxins, ethylene oxide, formaldehyde, and methylene chloride. Ambient air quality measurements for a variety of volatile organic compounds of interest to air programs were collected through the Toxic Air Monitoring Stations (TAMS) program. Data from the network were validated and incorporated into EPA's air toxics data base. The first set of Total Exposure Assessment Methodology (TEAM) studies measured personal exposures of more than 700 persons in 10 cities for multiple VOC's in air and drinking water together with exhaled breath concentrations. A comprehensive three-volume report of these studies was published during 1987. Studies of phosgene and p-xylene answered many questions about the kind and extent of the health effects posed by these compounds. The effects of several well-defined physiological or pharmacological treatments were investigated in rats, so that effect patterns could be recognized in humans and rats exposed to unknown hazardous air pollutants (HAP's). The identification of mutagenic and carcinogenic nitroaromatic compounds in combustion emissions and urban air particulate matter led to a major research effort in 1987 to understand the sources, exposures, metabolism, dosimetry, and effects of this class of organic compounds. Two wood stove field studies were completed involving over 70 homes in the Northeast and Northwest. A study and subsequent field testing for hospital sterilizer control systems were completed in late 1987. A small pilot-scale laboratory facility for evaluating the control of potentially toxic volatile organic compounds via adsorption was brought into operation during 1987. In addition, a report was prepared which describes the use of smog chambers and other data to determine the atmospheric lifetimes of eight air toxics currently under EPA review, and studies were conducted of the formation of mutagenic compounds in urban air, using a controlled system of simulated urban photochemistry.

Numerous mobile-source-related research activities were undertaken in 1987. The EPA conducted the first stage of a two-stage study to compare existing formaldehyde methodologies in a worst-case microenvironment, an underground parking garage. Upon completion, this study will result in base line formaldehyde measurements from which to judge the future impact of changing fuel mixtures and will provide tested monitoring methodologies for use by the monitoring communities. Air quality modeling efforts related to mobile sources were continued and research was conducted on the effects associated with methanol fuels and diesel particles. The neurobehavioral consequences of exposure to carbon monoxide continued to be monitored and reviewed. Mobile source emissions were characterized from a variety of motor vehicles under a number of different driving conditions.

The EPA also conducted a research project related to indoor air pollution in 1987. The Report to Congress, EPA's Indoor Air Quality Implementation Plan, was released in July 1987. Methods development activities included evaluation of analytical procedures for nicotine and polycyclic aromatic hydrocarbons (PAH's), development of new methods for polar organics, development of a miniature real-time monitor for NO_2, and continued evaluation of the canister technology for VOC collection. A field demonstration study was initiated to review the state of indoor monitoring technology and to develop an in-house capability to conduct monitoring research. A comprehensive and systematic research plan to investigate the health effects of exposure to volatile organic compounds emitted from building materials and furnishings was developed. Activated carbon was evaluated as a possible control measure for indoor organics. A facility for evaluating the effectiveness of indoor particle control devices was designed. With the cooperation of the Consumer Product Safety Commission, EPA conducted the first comprehensive emission characterization of the various designs of unvented kerosene heaters available to the public. An initial assessment of asbestos in residences was also completed in 1987.

In response to growing concern about the depletion of ozone from the stratosphere and resulting increases in harmful ultraviolet light, EPA increased its emphasis on research to determine the causes and effects of stratospheric ozone depletion. This program has two major components: ecological effects and control technology. A second Nitrous Oxide (N_2O) Workshop was held in Boulder, Colorado, which covered biogenic and combustion generated N_2O. Under the fundamental combustion research program, a kinetic combustion model was developed which has led to a better understanding of the formation/destruction pathways of N_2O during fossil fuel combustion. Documentation was completed on the cost of reducing or discontinuing the use of chlorofluorocarbons (CFC's) in producing rigid and flexible cellular foams, and in air conditioning and refrigeration. This documentation was used in the Regulatory Impact Analysis which supported the December 14, 1987 Federal Register notice proposing regulations limiting CFC's and halons.

In 1987, EPA established a program to address the causes and effects of global climate change. Workshops were held with experts from around the country to provide a sound foundation for the development of a long-range global climate change research plan.

Acid deposition research programs in EPA are coordinated through EPA's National Acid Precipitation Assessment Program (NAPAP), which is administered by the Interagency Task Force on Acid Precipitation. The objective of EPA's acid deposition research program is to develop necessary data to fully understand the sources and characteristics of acid deposition, the extent of damage or potential damage, and the corrective measures that may be used to diminish the problem.

In 1987, acid deposition research produced scientific information on the chemical status of a representative sample of lakes in the eastern United States, and developed a preliminary 1985 man-made emissions data base. The program established a cloud chemistry network to cover the major high altitude forest system in the eastern part of the nation. A deposition monitoring network was installed. Significant progress was made in determining the effects of acidic deposition on southern conifer and spruce/fir forests.

D. DEVELOPMENT OF NATIONAL AMBIENT AIR QUALITY STANDARDS

On July 1, 1987, EPA promulgated revisions to the air quality standard for particulate matter. The revised standard replaced total suspended particulate (TSP) as the indicator for particulate matter ambient standards with a new one that includes only those particles less than or equal to 10 micrometers in diameter (PM_{10}) and replaced the 24-hour primary TSP standard with a 24-hour PM_{10} standard of 150 micrograms per cubic meter with no more than one expected exceedance per year. In addition, the revised standards replaced the annual primary TSP standard with an annual PM_{10} standard of 50 micrograms per cubic meter expected annual arithmetic mean, and replaced the secondary TSP standard with 24-hour and annual PM_{10} standards that are identical to the primary standards in all respects. Also on July 1, 1987, EPA published an advance notice of proposed rulemaking soliciting public comment regarding the development of a new secondary ambient air quality standard for fine particles (those particles less than 2.5 micrometers in aerodynamic diameter). This action represents a continuation of the review process for secondary standards for particulate matter and addresses regional haze conditions associated with elevated levels of fine particles.

In April 1986, the Clean Air Scientific Advisory Committee (CASAC) reviewed a revised draft of the ozone criteria document and the first draft of the ozone staff paper. The CASAC completed its review of the criteria document in October 1986. At a December 1987 meeting, CASAC reviewed a revised staff paper and a research summary of more recent studies. Issues were discussed regarding the existing 1-hour standard and the possible need for new longer-term standards to protect against chronic health and welfare effects. At the conclusion of this session, CASAC did not feel the group had reached a point where it was adequately prepared to articulate and communicate its recommendations to the EPA Administrator and thus it called for an additional meeting in 1988. The CASAC plans to make recommendations to EPA following this meeting.

With regard to reviews of the carbon monoxide and nitrogen dioxide air quality standards, EPA began the process of preparing a new criteria document for carbon monoxide in 1987. An external review draft of the revised criteria document is scheduled to be available for public review in 1988. Development of the criteria document for nitrogen dioxide will be initiated in 1989.

Activities related to the review of the sulfur oxides air quality standard in 1987 focused on completing the staff paper addendum and the development of a regulatory package. The EPA announced a proposed decision to reaffirm the standards in April 1988.

With respect to the review of the ambient standard for lead, activities focused on updating and validating the lead exposure methodology. It is anticipated that CASAC will review a revised draft of the staff paper in 1988.

E. ASSESSMENT AND CONTROL OF TOXIC AIR POLLUTANTS

In 1987, EPA continued to implement an active program to screen and assess potentially toxic air pollutants for possible regulation under the Clean Air Act or other environmental authorities. A total of 34 chemicals or emission mixtures were in various stages of assessment at the end of 1987. Decisions not to pursue a regulatory program directed specifically at copper and zinc and zinc oxide were published in 1987. Decisions on whether to regulate 5-10 additional pollutants are expected in 1988. Also in 1987, final efforts were completed for a report to Congress on the National Dioxin Study, which was a coordinated effort of various EPA programs to assess the potential extent of contamination of the environment with chlorinated dioxin compounds. In addition, EPA also published a report to Congress on municipal waste combustors (MWC) in 1987. The report addresses EPA's preliminary assessment of the multi-media aspects of MWC, including releases to the air of dioxins, furans, acid gas, and hydrocarbons as well as traditional air pollutants. Based on the results of this study, EPA published an advance notice of proposed rulemaking in July 1987 that announced its intent to regulate municipal waste combustors under sections 111(b) and 111(d) of the Clean Air Act.

In July 1987, the U.S. Court of Appeals for the District of Columbia Circuit vacated EPA's 1985 withdrawal of a proposed revision of the National Emission Standard for Hazardous Air Pollutants (NESHAP) for vinyl chloride. In remanding the standard to EPA for reconsideration, the court held that EPA had not shown that the vinyl chloride standard adequately protects public health within the meaning of section 112 of the Clean Air Act. The EPA was in the process of considering how to respond to the remand at the end of 1987. In June 1984, EPA promulgated a NESHAP for benzene equipment leaks and withdrew proposed NESHAP's for benzene emissions from maleic anhydride plants, ethylbenzene/styrene plants, and benzene storage tanks. Following the vinyl chloride decision, EPA voluntarily accepted a remand of the benzene NESHAP to reconsider the three withdrawn benzene proposals and the benzene fugitive NESHAP. Final action on the remand is expected to be published in 1989.

In other activities related to emission standards for hazardous pollutants, work continued on revising the asbestos NESHAP during 1987 and a revision to the mercury NESHAP was promulgated. NESHAP development continued for chromium emissions from electroplating and industrial cooling towers and a proposed NESHAP for coke oven emissions was published. Work continued in 1987 on an ethylene oxide NESHAP for commercial sterilization chambers and on a perchloroethylene NESHAP for the dry cleaning industry. In addition, EPA continued work on an accelerated NESHAP development effort that will cover eight organic compounds (ethylene oxide, methylene chloride, ethylene dichloride, perchloroethylene, trichloroethylene, butadiene, chloroform, and carbon tetrachloride) for which intentions to list under section 112 of the Clean Air Act have been published.

Also in the area of hazardous pollutant emission standards, EPA has accepted a voluntary remand of all radionuclide NESHAPs and is presently working to repropose regulatory decisions for 12 source categories. In addition, EPA issued a notice in the Federal Register that announced its intent to regulate emissions from new and modified municipal waste combustion units using new source performance standards and section 111(d) plans for existing sources, and work commenced in 1987 on a rule to regulate emissions of volatile organic compounds and a number of toxic compounds from new and modified municipal landfills using new source performance standards.

The Resource Conservation and Recovery Act (RCRA) requires EPA to promulgate such regulations for the monitoring and control of air emissions at hazardous waste treatment, storage, and disposal facilities (TSDF's) as may be necessary to protect human health and the environment. Current EPA plans call for development of regulations for these facilities in three phases. The first group of standards addresses sources for which EPA can develop standards relatively quickly because similar sources have already been regulated under the Clean Air Act. These standards address air emission vent and fugitive emissions from some of the treatment devices that will be used to meet the RCRA land disposal restrictions. These standards were proposed in 1987. The second group of standards, which addresses the bulk of the sources, is scheduled for proposal in early 1989. The third group of regulations will cover certain subsets of the source categories for which EPA will likely be unable to develop rules during the second round. Work on this third group of sources is expected to begin in 1989.

In 1987, EPA continued to pursue that portion of its overall strategy to control emissions of air toxics that provides State and local air pollution control agencies with funding and technical support to evaluate specific point sources. Sources that are candidates for this program include those that have been identified through the Federal toxic air pollutant assessment program as well as those certified by State and local air pollution control agencies. In 1987, funding was provided for 22 State and local evaluations of potential high risk point sources in a variety of source categories.

In 1986, EPA initiated planning activities to encourage States to undertake new efforts toward assessing the scope and seriousness of current exposures to the mixtures of air toxic compounds which are believed commonplace in large metropolitan areas. The EPA provided funds under section 105 of the Clean Air Act and technical assistance to States to encourage them to undertake such assessment efforts in a number of areas. Initially, 30 areas with populations over one million people were targeted for some level of assessment. In 1987, available funds were provided through EPA Regional offices, technical guidance was developed and distributed, and available opportunities were utilized to provide evidence of the existence of the problem and promotion of assessment programs. As a result of these activities and of independent actions on the part of State and local agencies, several activities have been initiated and in many cases have progressed to an advanced stage. In addition, activity on several Integrated Environmental Management Projects (IEMP) was continued. These projects, while multimedia in nature, focus a major portion of study on the air toxics aspects of the urban environment. In 1987, effort was completed for the Baltimore area as a result of work in previous years. The Kanawha Valley (West Virginia) Phase I study was concluded and sampling was initiated in the Denver IEMP Study.

The EPA has established a goal to have quality programs in every State and major local agency that are adequate to carry out certain roles envisioned within the national air toxics strategy. During 1987, considerable progress was made toward meeting this goal. The progress was in part due to EPA's program to enhance State and local program development. This program uses available grant funds to promote multiyear planning on the part of State and local agencies and subsequent implementation of these plans for building their air toxics capabilities and programs. To assist in implementation of multiyear development plan activities, EPA expanded its program of technical support in 1987. First, EPA continued its practice of developing and distributing technical assistance documents for assisting State and local agencies to estimate air toxics emissions. Next, EPA's Control Technology Center (CTC) became fully operational in 1987 and activities of the National Air Toxics Information Clearinghouse (NATICH) were also continued. Finally, a series of national workshops were conducted to assist State and local agencies in the basic aspects of program development and implementation.

F. STATUS OF AIR QUALITY MANAGEMENT PROGRAMS

On July 1, 1987, EPA promulgated its revised NAAQS for particulate matter. The new indicator for particulate matter is called PM_{10}. At the same time, EPA published new regulations for implementing and monitoring the PM_{10} standards. These regulations initiated a program which requires the States to develop revisions to the State implementation plans to attain and maintain the new standards. Also published on July 1, 1987 was a notice soliciting comment on the need for a rural fugitive dust policy and presenting three alternatives to EPA's existing rural fugitive dust policy, and an advance notice of proposed rulemaking on a fine particle standard.

Over the past two years, EPA has been considering how it should deal with the continuing violations of the national ambient air quality standards for ozone and carbon monoxide in many urbanized areas across the country. The latest date for attainment mentioned in the Clean Air Act was December 31, 1987, and it is apparent that many areas would not be able to meet this deadline. The Act does not provide explicit direction on how to handle these "post-1987" situations although EPA believes that the Act does provide some guidance. The EPA proposed its post-1987 policy in the Federal Register on November 24, 1987. The proposed strategy incorporates the kinds of measures that can be implemented by Federal, State, and local governments. It lays out flexible deadlines that cities and States can meet through careful planning and determined implementation. It includes sanctions against areas that fail to make adequate progress and areas that fail to develop plans that demonstrate attainment within a near-term, fixed attainment date. It would prohibit construction of major new facilities if attainment of the standards is not projected within three or five years of the EPA's approval of required new State implementation plans.

Also in 1987, EPA continued to implement its Class I area visibility protection regulations by approving State submitted implementation plans and by promulgating Federal implementation plans to address integral vistas and long-term strategies for those States that failed to submit plans. These plans implemented the remaining portions of the regulations promulgated by EPA in 1980 implementing section 169A of the Clean Air Act.

In 1985, EPA adopted revisions to regulations originally promulgated in 1982 which prohibit reliance by stationary sources on stack heights in excess of "good engineering practice" or on any other dispersion techniques in lieu of emission controls. During 1986, EPA received SIP revisions from the States in response to the stack height regulations and most revisions pertaining to rule changes were processed by EPA by the end of 1987. Several interested parties filed for judicial review of the revised stack height regulations and, in addition, several of those parties also filed petitions for reconsideration of those regulations. Some of the petitions which dealt with a specific source were denied in 1986. Since the other petitions dealt with the basic legal foundations for the regulations, EPA deferred responding to them until judicial review of the revised regulations was completed. The Court of Appeals for the D.C. Circuit responded to the petition in January, 1988. While upholding most of EPA's regulations, it remanded to EPA three issues relative to a grandfathering provision, stack height credits allowed to certain pre-1979 sources, and certain sources with merged stacks.

With regard to the prevention of significant deterioration of air quality (PSD) program, in 1987, EPA continued its progress in transferring implementation of this program to State and local agencies. The majority of PSD permits are now issued by these agencies. As of the end of 1987, 47 State and local agencies had either full delegation of the PSD program or a PSD SIP, and 6 more had partial responsibility for the PSD program.

A matter of considerable controversy has been the definition of "source" for the purposes of nonattainment new source review. The Clean Air Act is not clear in this area. In 1980, EPA promulgated a plantwide definition that was challenged by environmental groups and resulted in an appeal to the U.S. Supreme Court. The Supreme Court upheld EPA's definition and, as a result, EPA developed a policy in 1987 which will aid in the processing of SIP's that pertain to the definition of source. This policy should significantly accelerate the processing of revisions to the nonattainment portions of SIP's.

In 1986, the Sierra Club and other environmental groups filed suit to force EPA to develop PSD regulations for NO_x, as required by section 166 of the Clean Air Act amendment of 1977. The last of these suits was filed in early February 1987. In April of 1987, the court ordered EPA to develop PSD regulations for NO_x on an expedited schedule. Specific deadlines were to propose regulations by February 9, 1988 and promulgate them by October 9, 1988. At the end of 1987, EPA was working toward completion of a Federal Register proposal notice in order to meet the court-ordered requirements.

In 1987, EPA announced proposals to disapprove State clean air plans for 14 metropolitan areas that have not shown they can achieve EPA's ozone and/or carbon monoxide air quality standards by the end of 1987 or in the near-term. Along with the disapprovals, EPA proposed bans on construction in those 14 areas for major new sources and certain major changes to existing sources of those air pollutants. The construction bans were proposed to go into effect upon a final determination by EPA and would prevent the approval of permits for building major new sources or modifications of existing sources of volatile organic compounds or carbon monoxide, depending on the pollutant for which the area is not attaining the standard.

During 1987, EPA formed a task group to investigate the basic approaches being used to review, comment on, and approve or disapprove revisions submitted both to existing and to new SIPs. Major improvements in the SIP processing system were recommended which dealt with the elimination of excessive review within EPA and improvement in the certainty of the decision process. Implementation of the recommendations of the task group will be undertaken in 1988.

In 1985 and 1986, EPA initiated a program of studies related to implementing possible acid deposition control programs that might be required. These studies, called State Acid Rain (STAR) projects, were to be conducted by individual States although the results could have broad applicability to other States that might be involved in a possible acid rain control program. By the end of 1987, work had been completed on 21 of the 46 total STAR projects, and EPA began summarizing the results for a final report on the program. Also, in 1987, EPA began an effort analogous to the STAR program to identify and study the implementation issues which will confront the State public utility commissions in an acid rain program.

Also in 1987, EPA continued to provide technical training in the abatement and control of air pollution. This training included short course presentations (3 to 5 days in length), self-study courses, technical assistance to others who conduct training, and the support of traineeships and fellowships for graduate air pollution training.

G. CONTROL OF STATIONARY SOURCE EMISSIONS

In 1987, work progressed on the development of emissions standards for those major source categories not yet regulated under new source performance standards (NSPS) and on the revision of various NSPS as appropriate. During 1987, NSPS were promulgated for emissions of volatile organic compounds from rubber tire manufacturing and volatile organic liquid storage tanks and for SO_2 emissions from industrial boilers. The existing NSPS for lime manufacturing plants was revised and the fossil fuel fired steam generator standard was amended to provide alternative compliance provisions for one power station. Standards were proposed for polymeric coating, petroleum refinery wastewater, polymers manufacturing, and residential wood combustion.

The EPA established the BACT/LAER Clearinghouse several years ago in order to assist State and local air pollution control agencies by promoting the sharing of air pollution control technology information. The primary output of the Clearinghouse is an annual report of information about BACT/LAER determinations made by the various control agencies. The report published in 1987 contains over 1300 BACT/LAER determinations.

H. STATIONARY SOURCE COMPLIANCE

The EPA conducted a number of activities in 1987 to assure that stationary sources of air pollution comply with emission standards. To do this, EPA currently monitors the compliance status of over 36,000 stationary sources of air pollution. Approximately 31,500 of these sources are Class A SIP sources, about 3,500 are NSPS sources, and about 1,000 are non-asbestos NESHAP sources. At the end of 1987, compliance rates ranged from approximately 87 percent for NESHAP sources to over 91 percent for Class A SIP sources.

The demolition and renovation of old buildings, often in densely populated urban areas, can be a major source of asbestos exposure. Such sources are regulated under the NESHAP for asbestos. During 1987, EPA and the States received 43,496 asbestos demolition or renovation notifications, conducted 17,616 asbestos inspections, and found 2,191 violations.

The Clean Air Act provides a variety of administrative enforcement mechanisms for dealing with both special situations and relatively easily corrected violations. During 1987, EPA issued immediate compliance orders under Section 113(a) of the Act to 185 sources (108 of which were asbestos sources) and issued or approved delayed compliance orders under section 113(d) for three sources. In addition, ten cases were initiated in 1987 under section 120 of the Act which is an administrative remedy designed to recoup economic benefit which may come from violating air pollution control regulations. The EPA is also authorized to file civil and criminal actions in Federal District Court to compel a source to comply with applicable requirements, to pay penalties, or both. A total of 73 Federal civil actions were filed in 1987 against stationary sources for violations of the Clean Air Act.

A major focus of the stationary source compliance program is the effort to return to compliance those sources considered to be "significant violators." For 1987, EPA identified 637 significant violators pending at the beginning of the fiscal year. By the end of the fiscal year, 490 had been addressed. Of these, 247 were returned to compliance, 108 were placed on an acceptable compliance schedule, and 135 had an enforcement action pending. In addition, 583 significant violators were newly-identified during fiscal year 1987 and, of these, 187 were addressed by the end of the fiscal year.

The EPA has concluded that in most major urban areas, small sources of volatile organic compounds must be controlled if the ozone air quality standard is to be reached. Consequently, EPA initiated a small source compliance program in 1987 to encourage these sources to comply with existing regulations. The special problems that small businesses experience have been taken into consideration and each jurisdiction has been given enough flexibility to allow for innovative and cost efficient approaches to control.

Encouraging the installation and use of continuous emission monitors is one component of EPA's continuous compliance effort. On July 28, 1987, guidance was issued calling for increased use of continuous emission monitors and integration of information reported by continuous emission monitors into surveillance/compliance activities.

The EPA also made significant progress in the area of enforcement-related training. During 1987, EPA prepared a multilevel curriculum for EPA personnel engaged in stationary source compliance inspections. The objectives are to ensure that every inspector can conduct advanced levels of inspection and that experienced personnel can stay current and can develop specialized skills.

A number of significant enforcement actions were decided by the courts in 1987. In United States v. Ford Motor Co., the Sixth Circuit held that the U.S. can enforce the current federally-approved State implementation plan even though the defendant and the State of Michigan had entered a consent judgment in State court invalidating the SIP regulation. In United States v. Wheeling-Pittsburgh Steel Corp., the Third Circuit also ruled that Federal enforcement of an existing SIP could proceed despite the pendency of a SIP revision. However, in American Cyanamid Co. v. EPA, the Fifth Circuit held that the agency could not pursue a section 120 penalty action until it rejected a State-proposed SIP revision which would have put the company in compliance.

With regard to compliance by Federal facilities with air pollution control requirements, a total of 369 Class A SIP, NSPS, and NESHAP Federal facilities are tracked in the air program. As of September 1987, 302

(81 percent) were in compliance, 11 were meeting schedules that will bring them into compliance, 26 were in violation and not yet on an acceptable schedule, and 7 were of unknown compliance status.

Section 306 of the Clean Air Act provides the authority for EPA to place facilities on the List of Violating Facilities, thereby prohibiting any Federal agency from procuring goods or services produced at that facility. During 1987 EPA listed two facilities under the Clean Air Act as a result of criminal convictions for violations of the asbestos removal standards, removed three facilities from the list, handled one appeal, and reviewed three recommendations to list. At the end of 1987, there were three facilities on the list for Clean Air Act violations, one decision to list pending appeal, and two listing proceedings pending.

I. CONTROL OF MOBILE SOURCE EMISSIONS

The EPA made significant progress in 1987 in implementing its mobile source control program. With the increased focus on reducing ozone levels, EPA has continued work on several areas directly aimed at this goal. One of the key actions is controlling excess evaporative emissions through regulation of in-use gasoline volatility. The EPA proposed a rule in 1987 on gasoline volatility and a final rule is expected in 1989. In addition, EPA proposed a rule establishing refueling emission standards for automobiles along with the gasoline volatility proposal. Another ozone-related action taken by EPA in 1987 was the continued development of a notice of proposed rulemaking which would tighten the light-duty truck exhaust hydrocarbon standard. Publication of the proposal is expected in 1988.

Three EPA initiatives were related to vehicle fuels in 1987. In the first, EPA began to develop a comprehensive study of the potential costs and benefits of reducing the sulfur and aromatics content of diesel fuel, an action that may lead to significant reductions in particulate emissions from diesel engines. A second initiative was a proposal to establish testing protocols to determine the health effects of fuels and fuel additives. Finally, a motor vehicle assessment for an Agency-wide task force on formaldehyde exposure and control strategies was completed.

The lead phasedown program required by EPA continues to achieve significant reductions in the use of lead in gasoline, from ten billion grams in 1986 to six billion in 1987. This represents a 97% decrease from the 206 billion grams of lead which were used in gasoline in 1973. In 1987, EPA and the U.S. Department of Agriculture (USDA) issued a study on the use of low-leaded gasoline (0.10 grams per leaded gallon) and unleaded gasoline in agricultural equipment designed for leaded gasoline, as required by the 1985 Farm Bill. A report to the President and the Congress was drafted for issuance in early 1988. As part of the program to reduce lead in gasoline, EPA prepared a final rule eliminating lead in test fuel in 1987. This will mean that manufacturers of engines not requiring catalysts, such as certain heavy-duty gas-powered engines, must meet emission standards using unleaded gasoline.

The EPA pursued several other mobile source regulatory activities in 1987. In anticipation of the development of methanol as an alternative fuel, EPA moved forward in the development of emission standards for methanol-fueled vehicles. The EPA held a workshop on and began developing a proposed rulemaking to permit the banking and trading of oxides of nitrogen and particulate matter emission credits among heavy-duty gasoline, diesel, and methanol engine manufacturers. The EPA continued to promulgate nonconformance penalties for those heavy-duty engine families unable to meet certain standards applicable to a given model year. A proposal to increase the stringency of the 1991 light-duty diesel truck particulate standard for light-duty trucks with heavy-duty engines and to propose nonconformance penalties was published in 1987. In addition, EPA incorporated newly received emissions data into a study of railroad emissions which it has been conducting. The complete study is scheduled for release in 1988.

One of EPA's key techniques for assuring the compliance of vehicles with the motor vehicle emissions standards is the preproduction certification program. Initiated in 1968, the program involves the engineering review and testing by EPA staff of engine families representing new vehicles which are to be sold in the United States. The EPA's National Motor Vehicle Emission Laboratory performed over 2,500 emission tests on 750 preproduction prototype vehicles and 500 in-use vehicles in 1987.

An effective strategy for dealing with in-use emissions problems is the establishment of motor vehicle inspection and maintenance (I/M) programs. In 1987, EPA continued to promote the implementation of I/M programs in each locality where they were needed. By the end of the year, 60 of 64 areas had initiated programs. To assure that operating I/M and antitampering programs actually achieve the planned emission reductions, EPA has initiated a systematic I/M auditing plan. In 1987, EPA notified governors or other high officials in 6 states that major problems had been found, and requested corrective plans. In addition to I/M programs, EPA has promoted the implementation of State and local antitampering and anti-fuel switching enforcement programs. By the end of 1987, 36 programs had been implemented.

The EPA mobile source enforcement program is directed primarily toward achieving compliance with motor vehicle emissions standards and fuel regulations as required by the Clean Air Act. In order to assure that production vehicles and heavy-duty engines are built in accordance with emissions standards, EPA conducts Selective Enforcement Audit (SEA) test programs at manufacturers' facilities. In 1987, EPA conducted 22 SEA'S, including four at foreign manufacturer's facilities, with a new effort in testing heavy-duty engines for compliance. Section 207(c) of the Clean Air Act authorizes EPA to order the recall of vehicles if a substantial number of any class of vehicles do not conform to emissions standards during their useful lives. During 1987, a total of 1,537,000 vehicles were recalled as a result of EPA investigations. In the same period, manufacturers voluntarily recalled an additional 1,408,706 vehicles to correct emissions problems. The EPA has greatly increased its lead phasedown enforcement activities. In 1987, EPA issued 18 Notices of Violation (NOV's) in this area with $24 million in proposed penalties. In a related area, EPA relaxed restrictions on a fuel additive waiver for a methanol blend in 1987. This is expected to become an increasingly important area in response to the ongoing lead phasedown program, as refiners experiment with various additives as substitutes for lead in vehicle fuel. The EPA is also responsible for carrying out programs designed to deter tampering with vehicle emissions control systems or using leaded fuel in vehicles which require unleaded fuel. Surveys undertaken by EPA in 1987 show that tampering and fuel switching are continuing serious problems which undermine the emissions control performance of many in-use vehicles. Tampering and fuel switching enforcement activities continued in 1987 with the issuance of 297 notices of violation with proposed penalties of $2.6 million. In addition, EPA is also responsible for assessing whether the Federal emission warranty requirements of sections 207(a) and (b) of the Act are implemented. During 1987, EPA responded to a total of 1,253 inquiries in this area.

The control of emissions from imported vehicles has become a major issue in recent years. In 1987, EPA received 20,000 applications and 29,000 inquiries concerning these automobiles. Also in 1987, EPA promulgated a final rule updating its regulations controlling these automobiles. The goal of these rules is to streamline the process for demonstrating compliance with Federal emission requirements. The EPA has also been investigating various laboratories to ensure that nonconforming imports have been tested properly to demonstrate conformity with U.S. emissions standards. In 1987, EPA successfully prosecuted five laboratories resulting in 27 individual convictions and one corporate conviction for falsifying test results.

Several mobile source litigation actions took place in 1987. In one, a U.S. District Court in New York City imposed a judgment for $180,000 against a corporation for a violation of the fuels provisions of section 211 of the Clean Air Act. Enforcement of lead phasedown also resulted in criminal prosecution of individuals. At least two criminal cases were pending at the end of 1987 which were developed in the course of EPA investigations. Other cases, including four related cases with potential penalties of $40 million, are currently pending. The EPA also issued notices to eighteen refiners or importers proposing a total of $24 million in civil penalties. In addition, in 1987 EPA continued to pursue litigation activities against manufacturers and installers of devices designed to illegally replace automotive catalytic converters.

J. STRATOSPHERIC OZONE PROTECTION

On December 14, 1987, EPA proposed regulations pursuant to section 157(b) of the Clean Air Act to implement the Montreal Protocol on Substances that Deplete the Ozone Layer, which was signed by 24 nations in September 1987. Currently, 30 nations including all the major chlorofluorocarbon producers have signed the Protocol. This landmark environmental agreement calls for a 50 percent reduction in use of CFC's and a freeze on use of halons over the next ten years. By reducing the future use and emissions of CFC's and halons, these restrictions will help to protect the earth's stratospheric ozone layer. The EPA proposed that control requirements only take effect if the United States ratifies the Protocol and following its entry into force. The Protocol is expected to enter into force on January 1, 1989, following ratification by eleven nations representing two-thirds of global consumption. The United States ratified the protocol in April 1988.

K. RADON ASSESSMENT AND REMEDIATION

The goal of EPA's Radon Action Program is to significantly reduce the health risks of radon through a partnership with other Federal agencies and the States. The Radon Action Program's initial efforts in 1985 were concentrated in the Reading Prong area of Pennsylvania, New Jersey, and New York where elevated levels of indoor radon were first discovered in homes. The EPA provided these States with assistance in radon measurement and mitigation of radon exposure in affected homes. Since then, high radon levels have been found in nearly every State and program activities were expanded in 1986 and 1987 in response to the growing scope and complexity of the radon problem. To accomplish its goal, EPA continues to develop and disseminate technical knowledge to encourage, support, and facilitate the development of State programs and private sector capabilities to reduce exposure to radon. The EPA's program focuses upon problem assessment, mitigation and prevention, capability development and public information.

While much of EPA's activity was initially directed at States in the Reading Prong area, the Radon Action Program is now assisting States throughout the country. Technical assistance activities will continue as an increasing number of States, Indian Nations and Federal agencies work to identify and address radon exposure problems. The EPA will also continue to expand its technical assistance capabilities in response to the increasing complexity of the radon problem.

L. LITIGATION

During 1987, two significant precedent-setting cases involving the Clean Air Act were decided in the courts. In a major ruling on EPA's obligations under section 112 of the Clean Air Act (NRDC v. Thomas), the entire D.C. Circuit held that while consideration of costs and feasibility is not precluded for purposes of setting standards for hazardous air pollutants, EPA must first determine a level representing an "acceptable risk." The court also concluded that section 112 does not require elimination of all risk, but that EPA should follow a process under which a decision is first made on a level representing an "acceptable risk" for a pollutant, followed by a second step in which cost and feasibility could be considered in providing an "ample margin of safety." The decision of the court modified a previous panel decision in the same case, issued in 1986, that upheld EPA's approach in all respects.

In another case of great significance to EPA's program for areas with serious nonattainment problems, the Ninth Circuit overturned EPA's partial approval of ozone and carbon monoxide SIP's for California's South Coast air basin, and ordered EPA to disapprove those SIP's for failure to meet the statutory requirements for attainment by December 31, 1987 (Abramowitz v. EPA). The EPA had initially approved the control measures in the SIP, but withheld approval or disapproval as to attainment. The court held that the Act does not authorize EPA to approve control measures independent of a determination on whether the SIP demonstrates attainment.

In addition to the Abramowitz decision discussed above, three other significant suits which had been filed to force State and Federal agencies to revise, implement, or promulgate SIP's were decided in 1987. In Natural

Resources Defense Council (NRDC) v. New York State Department of Environmental Conservation, the district court held that the plaintiffs were entitled to a finding of liability regardless of the State's reasons for failing to carry out its obligations, and ordered the State to promulgate certain regulations, including those addressing installation of gasoline vapor recovery devices on service station pumps. In *American Lung Association of New Jersey v. Kean*, the court rejected the State's good faith intentions, and interpreted New Jersey's 1983 SIP submission as binding, judging that any ambiguities in the SIP would properly be construed against the creator of the SIP--the State itself. In *Wilder v. Thomas*, the court held that the failure of the SIP to attain the national standard was not, in and of itself, a violation of a condition or requirement of a SIP, or otherwise actionable under the citizens suit provision of the Act.

In another decision, the Ninth Circuit upheld EPA's disapproval of an Arizona SIP revision for total suspended particulates and new source review, and imposition of a construction ban against a challenge by the State. In a second decision related to Arizona, the Ninth Circuit also upheld EPA's decisions to disapprove Arizona's carbon monoxide SIP's for the Tucson and Phoenix areas, and to impose construction bans.

In a case related to the prevention of significant deterioration provisions of the Act, a citizens group sued to compel EPA to issue regulations to prevent significant deterioration of air quality from emissions of nitrogen oxides. The EPA admitted it had failed to issue such regulations as required by the Clean Air Act and the opinion focused on how fast EPA should be required to act. The court imposed a deadline equivalent to the amount of time Congress originally allotted to EPA for taking the action. In a second related case, the D.C. Circuit dismissed a petition seeking to require EPA to complete rulemaking on whether strip mines should be subject to regulations governing fugitive dust. The court judged that a three year delay since issuance of proposed rules was not unreasonable under the circumstances.

II. AIR QUALITY TRENDS, MONITORING, AND MODELING

This chapter describes current trends in ambient air quality levels (the concentration of a given pollutant in the atmosphere), as well as trends in estimated emissions into the air of various pollutants. In addition, the chapter discusses the topics of air quality monitoring and air quality modeling. Data on ambient air quality levels and emissions are through 1986, the latest year for which EPA has complete statistics.

A. NATIONAL AIR QUALITY AND EMISSION TRENDS

Although considerable progress has been made controlling air pollution, it still remains a serious public health problem. In 1986, 75.0 million people were living in counties with measured air quality levels that violated the national ambient air quality standard for ozone. This compares with 41.7 million people for total suspended particulate, 41.4 million people for carbon monoxide, 7.5 million people for nitrogen dioxide, 4.5 million people for lead and 0.9 million people for sulfur dioxide.

Nationally, long-term 10-year (1977 through 1986) improvements can be seen for TSP, sulfur dioxide, carbon monoxide, nitrogen dioxide, ozone, and lead. The trend in ozone is complicated by a major drop in measured concentration levels which occurred between 1978 and 1979, largely due to a change in the ozone measurement calibration procedure. Therefore, special attention is given to the period after 1978, because the change in the calibration procedure is not an influence during this time.

The 10-year trend (1977-1986) is complemented with a more recent 5-year trend (1982-1986). The 5-year trend increases the number of sites available for trend analysis. Emphasis is placed on the post-1981 period to take advantage of the larger number of sites and the fact that the data from this period should be of the highest quality, with sites meeting uniform siting criteria and high standards of quality assurance. Nationally, improvements can be seen for all the pollutants during the 5-year period.

All of the ambient air quality trend analyses are based on monitoring sites which recorded at least 8 of the 10 years of data in the period 1977 to 1986 or 4 out of 5 years in the period 1982 to 1986. Each year had to satisfy an annual data completeness criterion.

Total Suspended Particulate (TSP) - Annual average TSP levels, measured at 1,435 sites, decreased 23 percent between 1977 and 1986. This corresponds to a 25 percent decrease in estimated particulate emissions for the same period. Air quality levels for TSP generally do not improve in direct proportion to estimated emission reductions, however, because air quality levels are influenced by factors such as natural dust, reentrained street dust, and construction activity which are not included in the emissions estimates. The EPA has also found that the TSP data collected during the years 1979-1981 may be biased high due to the glass fiber filter used during these years, and that most of the large apparent 2-year decrease in pollutant concentrations between 1981 and 1982 can be attributed to a change in these filters. The more recent TSP data show a leveling off with a 3 percent decrease in ambient TSP levels and a 4 percent decrease in estimated emissions for the 1982-86 time period. Some minor year-to-year fluctuations may in part be attributable to changes in meteorological conditions such as precipitation. On July 1, 1987, EPA promulgated new standards for particulate matter using a new air quality indicator, particles nominally 10 micrometers and smaller in diameter (PM_{10}), rather than TSP. (See Chapters IV and VI for more information related to the PM_{10} air quality standard.) These standards focus on those particles with aerodynamic diameters smaller than 10 micrometers, which are likely to be responsible for adverse health effects because of their ability to reach the thoracic or lower regions of the respiratory tract. Monitoring networks for PM_{10} are now being deployed nationally and future reports will present analyses based on the new particulate matter standards.

Sulfur Dioxide - Annual average sulfur dioxide levels measured at 302 sites with continuous sulfur dioxide monitors decreased 37 percent from 1977 to 1986, improving at a rate of approximately 4 percent per year. A comparable decrease of 43 percent was observed in the trend in the composite average of the second maximum 24-hour averages. An even greater improvement was observed in the estimated number of exceedances of the 24-hour standard, which decreased 98 percent. However, most of the exceedances as well as the bulk of the improvements occurred at source-oriented sites including a few smelter sites in particular. There was a 21 percent drop in sulfur oxide emissions during this 10-year period. The difference between emissions and air quality trends can be attributed to several factors. Sulfur dioxide monitors with sufficient historical data for trends are mostly urban population-oriented and as such do not monitor many of the major emitters which tend to be located in more rural areas. The residential and commercial areas, where most monitors are located, have shown sulfur oxide emission decreases comparable to the sulfur dioxide air quality improvements.

Carbon Monoxide - Nationally, the second highest non-overlapping 8-hour average carbon monoxide levels at 182 sites decreased 32 percent between 1977 and 1986. The median rate of improvement has been about 4 percent per year. The estimated number of exceedances of the 8-hour national ambient air quality standard decreased 89 percent between 1977 and 1986. Emissions of carbon monoxide decreased 26 percent during the same period. Because carbon monoxide monitors are typically located to identify potential problems, they are likely to be placed in traffic-saturated areas that may not experience significant increases in vehicle miles of travel. As a result, the air quality levels at these locations generally improve at a rate faster than the nationwide reduction in emissions. The 1985 and 1986 levels are similar and indicate improvement relative to previous years.

Nitrogen Dioxide - Annual average nitrogen dioxide levels, averaged over 111 sites, increased from 1977 to 1979, and decreased through 1986, except for a slight increase in 1984. The 1986 composite nitrogen dioxide average, however, is 14 percent lower than the 1977 level indicating a downward trend during the overall period. The trend in the estimated nationwide emissions of nitrogen oxides is similar to the nitrogen dioxide air quality trend. Between 1977 and 1986, total nitrogen oxide emissions decreased by 8 percent, and highway vehicle emissions, the source category likely impacting the majority of nitrogen dioxide monitoring sites, decreased by 13 percent. Between 1985 and 1986, the nitrogen dioxide composite average remained constant while the estimated emissions of nitrogen oxides decreased by 2 percent. This small year-to-year difference between the ambient levels and the emissions percent change is likely not significant given the relatively low ambient nitrogen dioxide levels.

Ozone - Nationally, the composite average of the second highest daily maximum 1-hour ozone values, recorded at 242 sites, decreased 21 percent between 1977 and 1986. However, this comparison is affected by a calibration change for ozone measurements that occurred in the 1978-79 time period. In the post-calibration period (1979-1986), ozone levels decreased 13 percent. Volatile organic compound (VOC) emissions decreased 19 percent for the 1977-86 10-year period and 20 percent for the post-calibration 1979-86 period. The estimated number of exceedances of the ozone standard decreased 38 percent between 1979 and 1986. The ozone trend in the post-calibration period shows 1979, 1980, and 1983 being higher than the other years. Meteorological conditions likely contributed to the higher 1983 levels.

Lead - The composite maximum quarterly average of ambient lead levels, recorded at 82 urban sites, decreased 87 percent between 1977 and 1986. Lead emissions declined 94 percent during the same period. In order to increase the number of trend sites, the 1982 to 1986 time period was examined. During this period, a total of 326 urban trend sites measured a 68 percent decline in ambient lead levels, while lead emissions were estimated to have decreased by 84 percent. Between 1985 and 1986 ambient lead levels declined 35 percent, while lead emissions are estimated to have declined 59 percent. This extremely large decrease in both air quality levels and estimated emissions is largely due to the reduction of the lead content of leaded gasoline.

B. AMBIENT AIR MONITORING

General

Section 110(a)(2)(C) of the Clean Air Act requires State implementation plans to include provisions for the establishment and operation of systems for monitoring ambient air quality. In addition, section 319 of the Act requires the development of uniform air quality monitoring criteria and methods and the establishment of an air quality monitoring system throughout the United States which uses uniform monitoring criteria and methods. To satisfy these requirements, EPA promulgated regulations in 1979 which required States to establish and operate air monitoring stations and report the data to EPA.[1] The two principal types of stations in the State networks are State and Local Air Monitoring Stations (SLAMS) and National Air Monitoring Stations (NAMS). The monitoring stations of the SLAMS and NAMS must adhere to the uniform monitoring criteria described in the regulations. These criteria cover quality assurance, monitoring methods, network design, and probe siting. January 1, 1981 was the deadline by which all NAMS were to meet all of the requirements in the regulations. The SLAMS had until January 1, 1983 to meet all of the provisions in the regulations. Based on 5 years of operating experience with the NAMS and SLAMS networks, some relatively minor modifications of the 1979 regulations were promulgated in the Federal Register in 1985.[2] These modifications were intended to simplify and improve the overall monitoring program required by the Act.

Overall, State and local progress in meeting the requirements of the regulations continues to be excellent. Table II-1 shows the status of the SLAMS network at the end of 1987. There are a total of 4,187 operating monitors in the network meeting requirements of the regulations. Table II-2 shows that 1,260 NAMS were in operation and meeting the requirements of the regulations through December 1987. Table II-3 lists, by pollutant, the number of SLAMS and NAMS.

Table II-1. SLAMS Status Through December 1987

	Number of Monitors
Monitors operational through 12/87	4,742
Total planned network for 1988*	4,567

*Includes NAMS monitors and includes 583 PM_{10} sites which will become part of the SLAMS network during 1988.

Table II-2. NAMS Status Through December 1987

	Number of Monitors
Monitors operational through 12/87	1,255
Total planned network for 1988	955*

*Total reflects the removal of 573 TSP sites and the addition of 273 PM_{10} sites during 1988.

Table II-3. National Summary of Operating Air Monitoring Stations (as of 12/87)

Pollutant	SLAMS (including NAMS)	NAMS
TSP	2,028	573
PM_{10}	583	-
SO_2	494	179
NO_2	226	58
CO	448	118
O_3	610	217
Pb	353	110
TOTAL	4,742	1,255

Particulate Monitoring

To accompany the proposed revisions to the national ambient air quality standard for particulate matter discussed elsewhere in this report, on July 1, 1987, EPA also promulgated amendments to 40 CFR 58 (Air Quality Surveillance and Reporting Regulations).[3] The revisions to Part 58 establish ambient air quality monitoring requirements for particulate matter as measured by a new reference method proposed as Appendix J of 40 CFR Part 50 or an equivalent method. The requirements are comparable to those already established for the other pollutants for which air quality standards have been set. These include requirements for reporting and assuring the quality of ambient particulate matter data, designing monitoring networks, and the siting of samplers. Since most areas of the country did not have particulate matter ambient monitoring data, EPA, in late 1984, procured 662 particulate matter samplers for distribution to State and local agencies. Since then funds have been allocated each year to procure additional particulate matter samplers. Specialized training was provided by EPA to State and local agency personnel on the operation and maintenance of the particulate matter samplers. Also, the States and local agencies have separately purchased particulate matter samplers, bringing the total number of operating particulate matter samplers to 884 at 583 sites as of December 31, 1987. The data from these sites will be used by the States in developing particulate matter State implementation plans.

Nonmethane Organic Compounds Monitoring

Ambient hydrocarbon data were collected at 32 sites during 1987. This was the fourth consecutive summer of field studies to measure nonmethane organic compounds (NMOC) in various cities. These data are needed to derive NMOC/oxides of nitrogen ratios, an important factor in predicting the effect of control programs to reduce ozone. As in past years, data capture was high and results were reproducible using different measurement techniques. Need for a similar program is envisioned for 1988.

C. AIR QUALITY MODELING

An air quality model is a set of mathematical equations that describes the atmospheric transport, dispersion, and transformation of pollutant emissions. By means of these equations, a model can be used to calculate or predict the air quality impacts of emissions from proposed new sources, emissions from existing sources, or changes in emissions from either of these source categories. These models are of great utility because they provide a means whereby the effectiveness of air pollution controls can be estimated before action is taken.

Regulatory Applications

During 1987 efforts to improve guidance on air quality models and to ensure consistency in their use continued. An air quality model clearinghouse was maintained to ensure that use of nonguideline techniques does not lead to inconsistent regulatory decisions. A workshop was held with modeling contacts in EPA's ten Regional Offices and five representative State agencies to improve communications on the use of models and to resolve common problems.

Regulatory action to update the "Guideline on Air Quality Models (Revised)[4]" continued with preparation of Supplement A which incorporates a new third level screening model, the Rough Terrain Diffusion Model (RTDM), adds a revised version of the Industrial Source Complex (ISC) model, lists the Offshore Coastal Dispersion Model as a preferred model for specific applications, and adds the AVACTA II model to the list of those models that can be used on a case-by-case basis. Notice of final rulemaking should take place in 1988 with distribution of Supplement A shortly thereafter.

All air quality dispersion model computer codes that support the regulatory guidance were transferred to EPA's new IBM 3090 system located at the National Computer Center at Research Triangle Park, North Carolina. Several supporting systems and procedures were also transferred and included significant enhancements allowing for greater user accessibility. For 1988, it is anticipated that several of the regulatory models will be converted for operation on EPA's personal computers.

Also during 1987, EPA continued to provide technical support and review of ozone model applications using the Empirical Kinetics Modeling Approach (EKMA). The EKMA is widely used by State and local agencies to estimate emission controls necessary to attain the ambient air quality standard for ozone. The EKMA computer program was upgraded and several draft documents describing how to apply EKMA are undergoing public comment. During 1988, EKMA will undergo further evaluation and will be revised to incorporate public comments.

To resolve issues associated with the analyses of State implementation plans for carbon monoxide, discussions were held with the Federal Highway Administration (FHWA) regarding requirements and procedures for modeling roadway intersections. A joint FHWA/EPA work group was formed to determine the most appropriate techniques for modeling intersections. In 1988 studies will be conducted to compare the emissions and traffic components of several available intersection models. A number of FHWA/EPA work group meetings will be held to arrive at a consensus on the most technically sound intersection modeling procedure. Guidance from both agencies will then be revised to reflect the recommendations.

Receptor models are data analysis tools frequently used to supplement air quality models or to replace them when appropriate dispersion techniques are unavailable. During 1987, EPA continued work on receptor models by finalizing the "Chemical Mass Balance (CMB) User's Manual."[5] Operation of the CMB program was described, along with further guidance on validating CMB applications and reconciling differences between receptor and dispersion model results. During 1988, computer software which facilitates application of the CMB model and helps users to review default source profiles in the U.S. EPA Receptor Model Source Composition Library will be developed. In addition, active assistance to States will be provided in applying receptor models to develop effective State implementation plans for attainment of the PM_{10} air quality standards promulgated in 1987.

In June 1987, EPA published the document "On-site Meteorological Program Guidance for Regulatory Modeling Applications."[6] This report provides EPA's guidance on the collection and use of on-site meteorological data intended for use in regulatory modeling applications. Recommendations are provided regarding specific procedures and methods from sensor selection and siting to data processing and quality assurance. Members of the work group responsible for preparing the document will continue their efforts in 1988 by reviewing and initiating the evaluation of techniques and procedures for determining on-site atmospheric stability.

Planning began in 1987 for the Fourth Conference on Air Quality Modeling. Section 320 of the Clean Air Act specifies that this conference be held every three years. The intended purpose of the next conference will be to report to the public on new models, procedures and related modeling issues being considered by EPA. The public will be invited to respond in a way that guides EPA in preparing any future notice of proposed rulemaking to revise the modeling guideline. The conference is being planned for September 1988 in Washington, D.C.

Air Toxics

Efforts were continued during 1987 to strengthen EPA's capabilities for modeling potential releases of toxic chemicals into the atmosphere. A refined model for the elevated, high-momentum release of heavier-than-air gases (such as might occur in the operation of a pressure relief safety valve) was developed under contract and is currently being assessed. Development of a model for estimating airborne concentrations from mechanical draft-cooling towers was completed in 1987, and the model is currently being used to assess the impact of chromium emissions from such towers. Plans for 1988 include the development and implementation of a refined modeling program which will more accurately predict the combined impact of continuous and short-duration pollutant emissions as well as the geographical extent of this impact under various meteorological conditions.

In addition, a major effort undertaken in 1987 involved the application of integrated air emission and dispersion models to facilities that treat, store and dispose of hazardous wastes. These models were used to estimate ambient concentrations of a large number of potentially hazardous substances emitted from the facilities. The concentration estimates were used to assess both carcinogenic and noncarcinogenic health effects associated with exposure to concentrations at the estimated levels. The results are being incorporated in the EPA program to determine the appropriate limits on air emissions of hazardous substances needed at these types of facilities. During 1988, supplemental modeling analyses will be performed in support of establishing these emission limitations.

Regional Ozone Modeling for Northeast Transport (ROMNET)

The ROMNET is a three year program to apply the EPA regional oxidant model for selected regional emissions control strategies on the Northeast. The program is designed to provide States, EPA and other planning organizations with information on the effectiveness of such strategies in reducing ozone concentrations in this region and also the data bases to support urban scale modeling for use in the development of State implementation plans. During 1987 the program protocol was prepared and distributed to participants for review. Outputs for 1988 will include establishing the management and technical committees which will be conducting the program, selection of episodes for model application, preliminary identification of regional strategies of interest, and completion of the base year emissions inventories.

Model Evaluation

During 1987 EPA continued its program to evaluate air quality models. This program was developed in response to recommendations of the American Meteorological Society (AMS) under its cooperative agreement with EPA. A statistical technique for intercomparing the performance of air quality simulation models was developed and tested using two rural air quality evaluation data bases. The technique relies on the bootstrap resampling procedure which results in confidence limits on the overall relative performance of two or more models. An important by-product of the bootstrap procedure is the ability to translate estimates of model reliability into confidence statements regarding the probable success of regulatory decisions. During 1988, EPA plans to develop additional information regarding how model accuracy may be used to determine confidence in model-based emission control limits.

In addition, the evaluation of toxics models was initiated in 1987. Toxic pollutant release types, models, and test data sets were identified. In 1988, test data set archiving and model selection will be completed and model performance evaluations will be initiated.

D. INTEGRATION OF AIR DATA SYSTEMS

The Aerometric Information Reporting System (AIRS) is a new integrated data system being developed by EPA to entirely replace the existing data bases, files, and software now used by EPA for storing and retrieving ambient air quality data, stationary source emissions, and compliance data. The AIRS is composed of two relatively separate components (air quality and facility data) but will use common sets of geographical and other codes and draw upon a state-of-the-art data base management system.

In 1986 the air quality component of AIRS went into full production within the Agency and was also installed in six pilot State agencies. Full implementation in another 19 State agencies was under way in 1987 with training, user manuals, and troubleshooting services being provided to the user community. Design of the integrated AIRS Facility Subsystem proceeded well during 1987 with the production system scheduled to be implemented by EPA in 1989. Replacement of existing software used by State agencies will begin in 1990.

E. EMISSION FACTOR DEVELOPMENT

In 1987, EPA published major revisions to emission factors for use by States and others to estimate source emissions and to compile emission inventories. Emission factor information is published and distributed for criteria pollutants in a publication entitled Compilation of Air Pollutant Emission Factors, AP-42.[7] The revisions were published in Supplement A[8] and distributed in early February 1987. Nearly all these revisions involve additions of size-specific emission factors, with emphasis on PM_{10}, for use in implementing the new PM_{10} ambient air quality standard promulgated in 1987. Additional criteria pollutant emission factors are being readied for publication in another AP-42 supplement in 1988.

F. REFERENCES

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3. 52 FR 24634 July 1, 1987.

4. "Guideline on Air Quality Models (Revised)," EPA 450/2-78-027R, 1986.

5. "Receptor Model Technical Series, Volume III (Revised) -- User's Manual for Chemical Mass Balance Model," EPA 450/4-83-014R, 1983.

6. "On-Site Meteorological Program Guidance for Regulatory Modeling Applications," EPA 450/4-87-013, 1987.

7. Compilation of Air Pollutant Emission Factors, Volume I, Stationary Point and Area Sources, AP-42, U.S. EPA, Research Triangle Park, N.C., September 1985.

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III. AIR POLLUTION RESEARCH PROGRAMS

A. INTRODUCTION

In support of the Clean Air Act, EPA's Office of Research and Development (ORD) provides health and ecological effects data bases, monitoring and modeling methods, risk assessments, emission reduction and mitigation technologies, and the corresponding quality assurance and technical assistance to develop regulations. In addition, ORD assists States in developing State implementation plans (SIP's) by providing improved monitoring, modeling, and control technology as they become available. In areas where EPA's responsibility is limited to providing technical and public assistance, such as indoor air quality and radon, ORD research provides essential information on risks, prevention, and mitigation.

B. GENERAL AIR POLLUTION RESEARCH ACTIVITIES

Significant changes were made in the focus of EPA's air pollution research program in 1987. The EPA began a program to study the effects of global climate change and possible strategies for eliminating or controlling emissions of compounds which contribute to global climate change. In view of the considerable problems associated with attaining national ambient air quality standards (NAAQS) for ozone, EPA accelerated efforts to refine the Regional Ozone Model and to improve technologies for controlling emissions of nitrogen dioxide (NO_2) and volatile organic compounds (VOC's).

For several years, ORD has maintained a small program to study the effects of increased levels of ultraviolet radiation in the 290 to 320 nanometer wave band (UV-B) on crops. Increases in UV-B radiation result from depletion of ozone in the stratosphere. In 1987, research on compounds which contribute to stratospheric ozone depletion was begun. Also in 1987, EPA developed an indoor air implementation plan and initiated work to develop a long-range research strategy for indoor air.

Scientific Support to Develop and Review National Ambient Air Quality Standards

Air Quality Criteria Documents - Work began on revision of the criteria documents for carbon monoxide (CO) and oxides of nitrogen (NO_x). An issue paper on the health effects of acid aerosols was drafted and peer reviewed in June 1987.[1] Research-needs documents for ozone and lead were prepared and reviewed in April by the Clean Air Scientific Advisory Committee, a standing committee of EPA's Science Advisory Board.[2,3]

Ambient Monitoring - In association with the July 1, 1987 regulatory changes which required monitoring of ambient particulate matter in the size range of 10 micrometers and smaller (PM_{10}), a new reference method and procedures for designating reference and equivalent methods for PM_{10} were promulgated. These are for use by States in their compliance monitoring networks. Two new chapters to Volume II of the Quality Assurance Handbook were prepared which address quality assurance and quality control procedures for current versions of PM_{10} samplers. A nonmethane organic compound (NMOC) monitoring project was carried out during the summer of 1987, the fourth in a continuing series to assist States in meeting current ozone national ambient air quality standards and to provide data needed by the agency in considering revisions to the ozone air quality standards. A seventh site was added to the network of the National Bureau of Standards (NBS)-Certified Standard Reference Photometers (SRP) that has been established to allow State and local air monitoring agencies to compare their ozone standards with authoritative NBS standards.

Quality Assurance - In accordance with the 1986 revisions to 40 CFR Part 58 Ambient Air Quality Surveillance, raw precision and accuracy data from each State and local air monitoring station (SLAMS) must be reported to EPA beginning January 1, 1987. With these data, probability limits are computed for each site and are made available to the originating agencies within a week of receipt of the data. These data will enable assessments and comparisons to be made on a site-by-site basis. Further, all data reported are identified by the specific method used at each site. Comparisons of the performance of the various methods for each pollutant measurement are now being made to identify where new or improved methods and quality assurance materials and procedures are needed. In 1987, capabilities of EPA and the State and local agencies to assess the performance of PM_{10} dichotomous samplers and continuous NO_2 monitors was sharply improved by development of audit materials for dichotomous flow and NO_2 monitors. These audit materials will be introduced into the National Ambient Air Performance Audit Program in early 1988.

Health Effects: Clinical Studies - Researchers in EPA's clinical laboratory observed pulmonary function and symptom responses in normal humans exposed to 0.12 ppm ozone for six and three-quarter hours. A follow-up to that study was begun to evaluate the concentration response at three different levels of ozone. The results of these studies will be used in conjunction with studies of pulmonary immune effects to determine the need for a long-term ambient air quality standard for ozone.

Several questions were answered about the effects of criteria pollutants in asthmatics. First in a study of NO_2 effects, mildly asthmatic subjects were exposed to one of three levels of NO_2 (0.15 - 0.60 parts per million [ppm]) while performing light exercise. No measurable pulmonary effects were seen, thus indicating that NO_2 at these levels does not aggravate breathing problems in mild asthmatics. In a similar study of sulfur dioxide (SO_2), bronchoconstriction was observed in mild asthmatics during two minutes of moderate exercise while breathing air containing 1.0 ppm SO_2. Results of another study of SO_2 in asthmatics were published in the American Review of Respiratory Diseases.[4] This study described the effects of continuous versus intermittent exercise in asthmatic subjects during exposure to SO_2. Another study was initiated in 1987 to determine the effects of SO_2, exercise, and cold or dry air on airway responses in asthmatics. To increase accuracy and consistency in studying the relationship between pollutant exposure and response in asthmatics, a method was devised to rank the severity of asthma, based on symptoms and clinical signs.

Health Effects: Non-clinical Studies - Studies with human pulmonary cells are in progress to evaluate the cellular response to in vitro ozone exposure. Pulmonary natural killer cells, alveolar macrophages, and pulmonary lymphocytes are being studied. The purpose of these studies is to examine man's ability to resist infections and determine whether mediators normally active in the lungs are affected by exposure to pollutants. They will provide data which will be especially useful in risk assessment activities.

Additional work to measure the amount of ozone removed in the nasal passages, the pharynx, the mouth, or the lungs was completed. A follow-up study is in progress to determine if there is a direct relationship between the amount of ozone removed and pulmonary function response to ozone. These studies are important to the extrapolation efforts being carried out by EPA's Health Effects Research Laboratory. In addition, these studies are seen by the program offices as critically important to regulatory and risk assessment activities.

All exposures (1 week, 3 weeks, 3 months, and 18 months) for the ozone/nitrogen dioxide (O_3/NO_2) chronic exposure study were completed. Additional animals were held in clean air for up to six months after exposure to determine progression or reversibility to disease. Preliminary results indicate significant pulmonary biochemical and structural changes, as well as aging effects. Final results are pending the completion of statistical analysis.

Studies designed to fill a significant data gap concerning the effect of ozone on susceptibility to viral infections showed that five repeated daily exposures to ozone enhanced the severity of influenza infection in mice if the infection occurred on the second day of exposure.[5] This effect did not appear to be due to effects on anti-viral immune defense mechanisms. Effects on viral susceptibility were not as dramatic as previously demonstrated effects on bacterial susceptibility.

The potential neurotoxicity of lead continues to be monitored. Mounting evidence suggests that lead neurotoxicity in children may result in hearing difficulties, even at relatively low blood lead levels. Based upon suggestive findings obtained from neurophysiological tests for children with elevated lead levels, and from analysis of data obtained from the second National Health and Nutrition Examination Survey, a neurophysiological test was inserted into a large ongoing longitudinal study of lead in children being performed by the University of Cincinnati. Initial evaluation of many of the children in the study has been accomplished. The EPA-funded portion of a study of the behavioral and neurophysiological effects of prenatal or postnatal exposure to lead in monkeys was completed, and a subset of the results was prepared and accepted for publication. Neurophysiological tests similar to those performed on children revealed effects suggestive of lead-induced auditory dysfunction. Behavior studies of these same monkeys suggested that exposure to lead increased the distractability of the monkeys. In 1988, the monkey study will be completed and data from the study of lead-exposed children will be analyzed.

Two peer-reviewed articles were published which described results to date from the study of lung cancer in China.[6,7] The study results were also presented in the Berlin International Conference on Indoor Air Quality and Climate in August 1987. This study may help our understanding of non-tobacco related environmental causes of lung cancer in humans.

Several on-going epidemiologic studies in the U.S. are assessing respiratory effects of ubiquitous air pollutants. The major emphasis of these studies is directed to acute and chronic effects of ozone, acid aerosols, and PM_{10}. Some of the studies have strong indoor air pollution components. Reports on various aspects of this work have been published during the year in scientific journals and presented at meetings.

Ecological Effects Studies - The National Crop Loss Assessment Network (NCLAN) reached its culmination in 1987 with an international conference on "Assessment of Crop Loss from Air Pollutants."[8] Over 150 researchers from around the world participated in the conferences. This conference included sessions on the need for crop loss assessment, the role of meteorology and atmospheric chemistry, regional monitoring and extrapolation, field approaches for measuring crop loss yield assessments, physiological understanding of crop losses, and several other topics. In 1987, eight journal articles, two proceedings, and one in-house report were published which described various results of NCLAN research.[9-19] Numerous other articles were accepted by reference journals and are in various stages of publication.[20-24]

In 1987, the initial work was done to prepare for a long-term study of the effects of ozone on forests and forest ecosystems. The shift from crop to forest research requires a substantially different research plan, although much of the exposure technology developed in NCLAN will be useful in the forest effects program.

Visibility Research - Preliminary results were published from an extensive cooperative monitoring program with the Department of Defense on the levels and sources of visibility impairment in the Mojave Desert of California.[25-28] An analysis for the study area indicates that the five most important pollutant species and their contributions to visibility are organics (24 percent), sulfates (23 percent), elemental carbon (20 percent), soil dust (19 percent), and nitrates plus NO_2 (14 percent). Worst case visibility conditions occurred during conditions of transport from the Los Angeles Basin and the Central Valley of California. Efforts were made to establish visibility monitoring in California and to develop visibility monitoring performance standards that will promote the collection of comparable data without hampering the future development of improved monitoring techniques.[29] A computer module has been developed which translates urban aerosol concentrations to visibility parameters.[30] This module can be used in conjunction with existing regional scale models to predict large-scale haze problems in the U.S.

Scientific Support to Develop New Source Performance Standards (NSPS) and State Implementation Plans (SIPs)

NO_x Control Activities - A new contract was awarded to apply reburning, a fuel staging combustion modification technology, to a coal-fired, cyclone utility boiler. Based on previous bench- and pilot-scale tests, an NO_x reduction of 50 percent or greater is expected. Reburning is the only known combustion modification technology which can achieve this level of NO_x reduction on cyclone boilers. The only alternative would be more costly flue gas treatment. Reburning has the potential to become an important retrofit technology if NO_x reductions from existing boilers are required in the future. This project is equally co-funded by EPA, the Electric Power Research Institute (EPRI), and the Gas Research Institute (GRI).

An in-house research project has resulted in the design of a heavy oil, low NO_x burner. This new design has two advantages over previous designs. It is smaller and it provides a better turndown ratio. The new burner utilizes a combination of the precombustor concept and reburning to achieve these goals. It is capable of firing nitrated fuel oil (e.g., No. 6 oil) or nitrated liquid waste but can maintain NO_x levels of approximately 125 ppm. A technical paper summarizing this research was accepted for publication in Environmental Progress.[31]

The 1987 Joint Symposium on Stationary Combustion NO_x Control was held in New Orleans in March 1987.[32] This four-day biennial meeting was co-sponsored with EPRI, and is recognized as the main international symposium on NO_x control technology. More than 350 professionals attended, including representatives and speakers from Canada, Europe, and Japan. It was apparent that NO_x control is of growing concern worldwide, based on information provided in approximately 50 technical papers.

Flue Gas Desulfurization (FGD) Activities - Development of a low-cost process for sulfur dioxide control continued in 1987 as part of the advanced FGD program. A process for duct injection of damp calcium silicate powder has shown greater than 90 percent SO_2 removal with fabric filters, and over 50 percent removal in the ducts. Four patents are being filed and one vendor is planning a demonstration of the advanced silicate (ADVACATE) process.

Scale-up to commercial size during 1988 will be made through a cooperative agreement between EPA and a major FGD vendor. Application to waste incinerators for acid gas emission control will also be developed. The electrically stimulated fabric filters (ESFF) particulate removal system which was developed previously was found to decrease emissions and achieve a lower pressure drop when compared to conventional fabric filtration. A mathematical model has been developed to predict non-uniform deposition of particulate matter and relative pressure drop expected.

Modeling Support Activities - An improved chemical reaction mechanism was developed to quantify the atmospheric formation of ozone from its precursors (hydrocarbons and oxides of nitrogen).[33] This mechanism, which uses a lumping procedure to characterize the hydrocarbon mixture, will provide an alternate approach to the carbon bond mechanism currently used in some ozone air quality models to develop cost-effective ozone control strategies. A paper was prepared which describes the role of hydrocarbons and nitrogen oxides in the formation of atmospheric ozone.[34] The paper examines the air quality impact associated with various emission control scenarios for achieving the ozone air quality standard.

A computer model which quantitatively describes the formation and removal of ambient particulate matter was developed. This model, designed to operate in conjunction with an existing regional scale model, will allow a more accurate prediction of the air quality impact of control abatement strategies for particulate matter.

A new tracer technique was applied to estimate source strengths of pollutant emissions which are normally inaccessible with conventional techniques. This technique may be applied to estimate surface release of fugitive emissions.

Based on an air quality and emissions data base obtained during a 1982 field study in Philadelphia, the Pollution Episodic Model (PEM) was evaluated. The PEM model, which incorporates important atmospheric processes, such as dry deposition and sedimentation, will be used to predict short-term concentrations of particulate matter for urban areas.

The EPA's Fluid Modeling Facility was used extensively to simulate a wide variety of air pollution processes. A report was prepared which documents these simulations, including those that can be used to assess the impact of terrain roughness, air flow near buildings, and roadway turbulence on air quality.[35]

Monitoring Support Activities - Two procedures for sampling stationary source emissions of PM_{10} were evaluated in field tests. The two test methods are entitled Emission Gas Recycle (EGR) and Simulated Method 5 (SIM 5). The EGR method allows for a longer term and potentially more accurate measurement to be made. The SIM 5 method allows several size-classified Method 5-type samples to be collected for PM_{10} and therefore does not require the special testing equipment of the EGR method. Both of these procedures will be recommended for use in SIP's when ambient air quality standards are exceeded and additional PM_{10} control strategies must be employed.

Scientific Support to Develop Regulations for Hazardous Air Pollutants (HAPs)

Health Assessment Documents - In 1987, the Health Assessment Document for chromium was updated through the completion of an issue paper which describes the health effects of substitutes for chromium in cooling towers.[36] New Health Assessment Documents were published for beryllium, acrolein, acetaldehyde, chlorine/hydrogen chloride, and phosgene.[37-41] Draft Tier I health summaries were prepared for nine compounds. These were sodium hydroxide, hydrogen cyanide, hydrogen fluoride, inorganic phosphorus, organic phosphorus, methanol, dimethylamine, non-asbestos mineral fibers, and naphthlene.[42-50] Final Tier I health summaries were completed for propylene oxide and zinc/zinc oxide.[51,52]

A summary report was prepared which detailed the results of an October 1986 workshop on multimedia approaches to assessing and managing hazardous air pollutants.[53] This workshop was conducted in conjunction with the North Atlantic Treaty Organization. In cooperation with the Office of Air Quality Planning and Standards, ORD produced a survey of EPA risk assessment methods for incineration for use by the Air Office and the Office of Solid Waste in regulatory decision-making.[54] A draft document on interim methods for developing inhalation reference doses was prepared and reviewed at a public workshop held in October 1987.[55]

Monitoring, Measurement Development, and Quality Assurance - Cryogenic preconcentration and stainless steel canisters were used to collect volatile toxic organic compounds in air samples before analysis by gas chromatography and/or mass spectrometry. These methods were demonstrated in a mobile van established for real-time analysis during a two-week field study in Virginia. These collection procedures reduce the possibility of artifacts produced by some solid sorbent collection methods. A portable gas chromatograph was also evaluated. This device employs a very sensitive photoionization detector, which produces real-time analysis of volatile toxic organic pollutants without preconcentration. It provides an inexpensive rapid screening method for organic air pollutants where unambiguous pollutant identification is not required.

A joint US-USSR air monitoring field study was conducted in June 1987 at Research Triangle Park, North Carolina, to compare U.S. EPA canister collection methods for volatile organic compounds with USSR solid sorbent collection methods. This study was conducted under the guidance of the US-USSR Joint Committee on Cooperation in the Field of Environmental Protection.

New pattern recognition techniques for classification and identification of toxic and potentially toxic organic pollutants from gas chromatographic-mass spectrometric monitoring data were developed and tested. These procedures were successfully evaluated on calibration and actual field monitoring mass spectral data for target compounds. The methods are applicable to environmental media other than air and can be applied retrospectively to archived data. The classification results alone may be of use for survey studies, particularly in determining human health risk.

The development, evaluation, and validation of source test methods to support the regulatory process included studies of methods for a number of organic compounds, including acrylonitrile, butadiene, carbon tetrachloride, chloroform, dioxins, ethylene oxide, formaldehyde and methylene chloride. The dioxin investigations uncovered problems with the sampling method when high concentrations of particulate are present. The method for methylene chloride was validated. A method for cadmium emissions from stationary sources was also investigated and validated. A study was undertaken of continuous emission monitors for benzene emissions from gasoline bulk storage facilities. The study was completed and a set of performance specifications was developed for the monitors.

Ambient air quality measurements for a variety of volatile organic compounds of interest to air programs are being collected through the Toxic Air Monitoring Stations (TAMS) program. Multiple monitoring stations are operated in Houston, Boston, and Chicago while a single site has been established in the Seattle-Tacoma area. Samples are collected over a 24-hour period every twelfth day and sent to a central analytical laboratory for analysis. Sample collection mechanisms have been run in parallel at a selected site in Houston to evaluate method comparability. Currently, samples are collected in 6-liter stainless steel canisters and analyzed by gas chromatography-mass spectrometry detection (GC/MSD). Data from the network are validated and incorporated into EPA's air toxics data base.

The first set of Total Exposure Assessment Methodology (TEAM) studies measured personal exposures of more than 700 persons in 10 cities for multiple volatile organic compounds (VOC's) in air and drinking water together with exhaled breath concentrations. A comprehensive three-volume report of these studies was published during 1987.[56-58] A major finding was that personal and indoor concentrations of many of the measured compounds exceeded outdoor levels, even in petrochemical refinery areas of northern New Jersey[59] and southern California.[60] Important sources of exposure were cigarette smoking for benzene and styrene,[61,62] hot shower use for chloroform, dry-cleaned clothes for tetrachloroethylene, and moth crystals and room deodorizers for paradichlorobenzene.[63]

In order to re-examine and extend these important results, a new group of TEAM studies employing recently developed methodology was conducted during 1987. VOC studies using canister and Tenax samples were performed in Los Angeles and Baltimore. In Los Angeles, approximately 50 homes and individuals from the previous study were resampled during both February and July. In Baltimore, a new TEAM location without petrochemical refiner proximity, over 800 canister samples and a larger number of Tenax samples were collected from 155 Baltimore area residents. The laboratory analyses for a set of 25 VOC's are now complete for both studies; statistical analyses are still in progress. Planning for a follow-up study in northern New Jersey has been completed. A screening study of 22 houses was performed in October to select 11 homes for a December study for sources of exposure to benzene, tetrachloroethylene, and paradichlorobenzene. A particle exposure study has also been planned with data collection scheduled for next year.

Health Effects Studies - Studies of phosgene and p-xylene answered many questions about the kind and extent of the health effects posed by these compounds. Inhalation of phosgene resulted in suppressed pulmonary immune response which, in turn, compromises the body's defenses against infections or neoplastic diseases. Phosgene also caused increases in drug-induced sleep, thereby suggesting an effect on the metabolic function of the liver. P-xylene also affected the liver when combined with carbon tetrachloride. Neither p-xylene nor carbon tetrachloride alone caused such an effect. P-xylene was also shown to affect the nervous system by interfering with protein synthesis. Inhalation of p-xylene at high levels produced significant changes in flash-evoked potential. The method used to determine the neurobehavior effects of p-xylene in animals can also be used in humans and is being testing in humans exposed to toluene.

In 1987, the effects of several well-defined physiological or pharmacological treatments were investigated in rats, so that effect patterns could be recognized in humans and rats exposed to unknown hazardous air pollutants (HAP's). Among the treatments examined were urethane hypothermia--a common consequence of HAP exposure, and the amino acid blocker called ketamine.

Neurotypic and gliotypic proteins were investigated as biochemical markers for detection of neurotoxicity. Work describing the regulation of these proteins by glucocorticoids and environmental challenge was completed and prepared for publication. In addition, as part of the validation process, it was demonstrated that acute exposure of the neonatal rat to a prototypical neurotoxicant, triethyltin, produced persistent changes in both neurotypic and gliotypic proteins.

The identification of mutagenic and carcinogenic nitroaromatic compounds in combustion emissions and urban air particulate matter has led to a major research effort to understand the sources, exposures, metabolism, dosimetry, and effects of this class of organic compounds. Using a bioassay directed fractionation and chemical characterization, it was determined that many of the polar mutagens present in ambient air are polycyclic aromatic hydrocarbons (PAH's) with a nitro substituent (NO_2-PAH's). Humans are also exposed in urban air to many nitroaromatic compounds with additional oxygenated substituents (e.g., nitrophenols and other ring substitutions such as nitrogen heterocycles. The first nitroaromatic compound identified was 1-nitropyrene, which was present in diesel emissions together with many other NO_2-PAH's and dinitro PAH's (e.g., 1,6-dinitropyrene). Many nitroaromatic compounds are mutagenic and several have been shown to be carcinogenic in animals. The dinitropyrenes, however, have exceptionally high mutagenic activity and when present in mixtures at concentrations less than a part per million, are found to contribute substantially to the ultimate mutagenicity and carcinogenicity of these mixtures.

Deoxyribonucleic acid (DNA) adduct studies, using the 32p-postlabeling method, successfully detected and quantitated the DNA adducts resulting from human exposure to complex combustion emissions, as well as animal and cellular exposures. Research was completed on a comparison of two methods to increase sensitivity in the postlabeling adduct assay. DNA adduct studies using this highly sensitive postlabeling method were applied to lung cells as well as human intestinal bacteria treated with individual PAHs and NO2-PAHs as well as complex mixtures to determine DNA adduct types and levels. These studies have successfully detected and quantified the C-8-animopyrene DNA adduct resulting from nitroreduction of 1-NP in both tracheal cells and anaerobic human microflora.

Direct mutagenesis bioassay methods were developed to assess gaseous mutagens. These methods have been applied to smog chamber studies of individual hydrocarbons (e.g., toluene, propylene, ethane) and recently to chlorinated hydrocarbons. These studies show that atmospheric transformation can often increase the mutagenicity and potential cancer risk of hydrocarbons in the atmosphere.

Wood Stove Control Studies - Two wood stove field studies were completed involving over 70 homes in the Northeast and Northwest. Results showed that the emission reduction performance of stoves meeting EPA's proposed 1990 wood stove new source performance standard was highly variable. On average, catalytic stoves achieved only a 25 percent emission reduction relative to conventional stoves as contrasted with lab tests showing a 90% reduction. Corresponding results for low emission noncatalytic stoves were 30% in the field versus 85% in the lab. In a few cases, however, the new technology stoves performed very well indicating that the technology has the potential to reduce this most significant source of emissions of PM_{10} and polycyclic organic matter. It is believed that operator variances such as improper fuel loading play a significant role in the ability of the technology to achieve its potential for emissions reductions. Follow-on work is planned in 1988 to better understand why the new technology did not perform consistently well and what changes should be implemented to achieve anticipated emission reductions consistently.

A study and subsequent field testing for hospital sterilizer control systems was completed in late 1987. A total of seven potential control concepts was reviewed. Two concepts were selected for field and laboratory testing including acid hydrolysis and low temperature catalytic oxidization. Test results indicate that both techniques have destruction efficiencies of up to 99 percent.

A small pilot-scale laboratory facility for evaluating the control of potentially toxic volatile organic compounds via adsorption was brought into operation during 1987. Testing of the effect of relative humidity on single component adsorption of three compounds on activated carbon was completed.

Atmospheric Formation of HAP's - In 1987, a report was prepared which describes the use of smog chambers and other data to determine the atmospheric lifetimes of eight air toxics currently under EPA reviews. Smog chamber studies can be used to simulate a variety of atmospheric conditions and provide useful information on atmospheric lifetimes and transformation products.

Studies were conducted of the formation of mutagenic compounds in urban air, using a controlled system of simulated urban photochemistry.[64] The results to date using smog chamber irradiation studies suggest that the gas phase reaction products show higher mutagenicity than the particulate phase.

Integrated Air Cancer Program - A major field study was conducted in Boise, Idaho, where both wood stoves and mobile sources contribute to high concentrations of particulate and organic matter. A large number of samples were collected, including airborne particles, semivolatile and volatile organics, acid, and aldehydes. These samples are currently being chemically characterized and studied in other mutagenesis bioassays and whole animal tests.

Scientific Support to the Mobile Sources Program

Exposure Monitoring and Modeling - The EPA's Office of Mobile Sources has been concerned that the level of exposure to formaldehyde might increase as more automobiles burn fuel containing methanol. ORD conducted the first stage of a two-stage study to compare existing formaldehyde methodologies in a worst-case microenvironment, an underground parking garage. The first stage of the study was conducted during a period of high photosensitivity (summer) and the second stage will be conducted during a period of low photosensitivity and when direct automobile emissions are more likely to be the highest (winter). Upon completion, this study will result in baseline formaldehyde measurements from which to judge the future impact of changing in fuel mixtures and will provide tested monitoring methodologies for use by the monitoring communities.[65]

Two modeling efforts were continued: validation and modification of existing exposure models--Simulation of Human Air Pollutant Exposure (SHAPE)[66] and the National Ambient Air Quality Standards Exposure Model (NEM)[67] and development of an automotive emission exposure model. Particular emphasis has been directed toward modification of NEM to include minute-by-minute activity patterns based on actual measured activity profiles. This improvement, once incorporated, will more accurately estimate exposure for both seasonal and national projections. Development of a two-stage automotive emission exposure model continued with improved predictive power which is superior to any of the 33 models initially developed, with about 75 percent of the variation in observed commuter exposure explained.[68]

Health Effects Studies - The neurobehavioral consequences of exposure to CO continue to be monitored and reviewed. Controversy has existed about the levels of exposure to CO which produce neurobehavioral effects. A major difficulty in performing and evaluating this work has been that studies are generally performed at or near the presumed threshold level for effect. In addition, the rate at which exposure occurs may be a significant variable. In 1987, studies were performed in which humans were exposed to levels of CO sufficient to produce carboxyhemoglobin (COHb) levels of 16-23 percent. Most literature suggests that these exposures should be sufficient to produce symptoms, yet no symptoms were reported by the subjects in this study. In addition, no effects were observed on the electroencephalogram or on compensatory tracking. A report describing these data has been accepted for publication by the Journal of Neurotoxicology and Teratology. Researchers attempted to replicate the findings of previous authors at lower COHb levels. In these studies, humans were requested to perform a sophisticated task requiring eye-hand coordination in the tracking of a visual stimulus. These experiments succeeded in repeating the earlier findings, thus indicating a mild tracking deficit after exposure to levels of CO sufficient to produce COHb levels of 5-6 percent. A current study is exploring the differences between the rapid attainment of high COHb levels and the low attainment of low (5-6 percent) COHb levels.

Emissions Studies - Mobile source emissions were characterized from a variety of motor vehicles under a number of different driving conditions. In one study, the effects of fuel volatility and methanol blend usage on evaporative emissions was determined.[69] The results suggested that evaporative emissions with methanol-gasoline blended fuels were nearly equivalent to corresponding emissions with gasolines of similar volatility characteristics. In another study, the influence of ambient temperature on tailpipe emissions from light duty gasoline motor vehicles was investigated.[70] This study provides quantitative emissions data on speciated hydrocarbons, aldehydes, and carbon monoxide concentrations emitted at lower ambient temperatures. The study showed that the concentrations of these pollutants increased as temperature decreased. Additionally, the rate and composition of refueling emissions were determined using laboratory simulations of summer and winter refueling conditions. The emissions were determined to be dominated by the volatile butane and pentane components of gasoline.[71] A study was also published describing the organic composition of tailpipe and hot soak evaporative emissions from 46 consumer-owned motor vehicles. Emission rates of 82 hydrocarbon and 10 aldehyde compounds were reported.[72]

Scientific Support to EPA's Indoor Air Program

Scientific Assessment - A report to Congress, "EPA Indoor Air Quality Implementation Plan," was released in July 1987.[73-77] This five-volume document was jointly prepared by ORD and EPA's Office of Air and Radiation. A draft research needs statement was completed that identifies the indoor air research questions still to be addressed by EPA and other Federal agencies. A matrix manager was designated to provide overall coordination and quality control of the indoor air research program.

Monitoring and Exposure Activities - Methods development activities included evaluation of analytical procedures for nicotine and PAH's, development of new methods for polar organics, development of a miniature real-time monitor for NO_2, and continued evaluation of the canister technology for VOC collection. A field demonstration study was initiated in response to Scientific Advisory Board recommendations that EPA review the state of indoor monitoring technology and develop an in-house capability to conduct monitoring research. The planned effort includes a measurement precision study conducted at the EPA/AEERL test home in Cary, North Carolina, followed by an applied effort in Baltimore, Maryland. Methodologies being reviewed in the program include those for VOC's, semivolatile organic compounds (SVOC's), particulate matter in the size range of 2.5 micrometers and smaller ($PM_{2.5}$) and PM_{10} particle fractions, metals, air exchange rate and nicotine. The problem of "Sick Building Syndrome" was addressed by supporting several external field efforts aimed at not only identifying problems, but developing questionnaires and procedures to assist State/local agencies in responding to complaint situations. One of these studies is at the Library of Congress facilities in Washington, D.C. where occupant complaints have baffled researchers trying to find causes.

Health Effects Research - A comprehensive and systematic research plan to investigate the health effects of exposure to volatile organic compounds emitted from building materials and furnishings was developed. Initial work focused on planning, implementing, and replicating the essential features for a Danish study. The Danish study was aimed at determining whether sick building syndrome complaints could be accounted for by exposure to a mixture of 21 volatile organic compounds. The most important finding of the study was that memory appeared impaired in those exposed to low concentrations of this mixture. Because of the potential significance of this finding and some critical flaws in the experimental design, careful plans were made to replicate this study. During 1987, a protocol was developed, the human exposure chambers were modified to accommodate this complex mixture, the behavioral testing component was largely computerized and plans were made for computer acquisition of the data. The attempt to replicate the Danish study will be made during 1988.

Source Characterization and Control Technology - Activated carbon was evaluated as a possible control measure for indoor organics. For the low concentrations expected in indoor environments, carbon does not appear to be a feasible control technology. Alternative VOC control techniques will be evaluated in 1988. Measurements of particle size distribution of typical indoor air particulate matter were made in a typical office. The data show that the particulates all fall into the PM_{10} range.

A facility for evaluating the effectiveness of indoor particle control devices was designed and is under construction. This facility will be used to determine air cleaner effectiveness for all particle size ranges expected in the indoor environment. Ozone generation by electrostatic precipitator (ESP's) will also be determined.

With the cooperation of the Consumer Product Safety Commission (CPSC), EPA conducted the first comprehensive emission characterization of the various designs of unvented kerosene heaters available to the public. While numerous studies of kerosene heaters have been conducted relative to criteria pollutants, only limited data on organic emissions were available. These preliminary data suggested a potential major health problem based on particle-bound, semivolatile organic emissions and the large number of kerosene heaters (several million) in use in the U.S. In the 1987 study, kerosene heaters of various designs were evaluated. Particulate, organic, and inorganic emission data were collected. This comprehensive assessment identified high emissions of acid aerosols which are believed to cause respiratory illness. The particulate matter was evaluated via bioassays to determine mutagenic potential; emissions from all of the heaters gave positive bioassay results. While full evaluation of the data from this study has not been completed, preliminary assessments indicate that kerosene heater emissions pose a serious health threat to exposed individuals.

In order to provide a full-scale, controlled research environment, EPA established a test house in the vicinity of Research Triangle Park, North Carolina. The test house will allow evaluation of the emission characterization results obtained in our chamber research vis-a-vis their application to an actual indoor environment. The house also serves as a "test platform" for the evaluation of indoor air quality (IAQ) monitoring equipment, the evaluation of IAQ control strategies and techniques, and the evaluation of IAQ models. To date, air exchange measurements and background organic characterization have been accomplished, and testing has been conducted on kerosene heaters and moth crystals. Data evaluation for the kerosene heaters is underway. Concentrations of paradichlorobenzene from moth crystal cakes placed in a closet were measured at several locations in the house and were used to evaluate a user-friendly, general purpose IAQ model which EPA is developing. The model provides a useful set of tools for analysis of IAQ issues.

An initial assessment of asbestos in residences was completed. The assessment showed that residences with asbestos building material and insulation have airborne asbestos. The probable risk due to the measured levels of asbestos are being assessed.

Scientific Support for the Stratospheric Ozone Program

In response to growing concern about the depletion of ozone from the stratosphere and resulting increases in harmful ultraviolet light, EPA is increasing its emphasis on research to determine the causes and effects by stratospheric ozone depletion. This program has two major components: ecological effects and control technology. The largest part of the program consists of research on the effects of radiation in the 290-320 nanometer wave band (UV-B) on food crops. Major crop systems such as soybeans and wheat have shown measurable damage after prolonged exposure to UV-B radiation.[78-82] Research was begun in 1987 to quantify the range and degree of injury on growth and yield. Research was also conducted on the influence of UV-B on plant competition pike, seedling growth, and marine ecosystems.[83-85]

A second workshop was held in Boulder, Colorado, which covered biogenic and combustion generated N_2O. The workshop was co-sponsored by EPA, National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, and United States Department of Agriculture, and had approximately 50 attendees, including representatives from government, industry, and universities.

Under the fundamental combustion research program, a kinetic combustion model was developed which has led to a better understanding of the formation/destruction pathways of N_2O during fossil fuel combustion. Preliminary test burns with gas and coal have verified the model.

Documentation was completed on the cost of reducing or discontinuing the use of chlorofluorocarbons (CFC's) in producing rigid and flexible cellular foams, and in air conditioning and refrigeration. This documentation was used in the regulatory impact analysis which supports the December 14, 1987, Federal Register notice proposing regulations limiting CFC's and halons. Reports were prepared which detail CFC consumption, emission, and control options for rigid and flexible cellular foam production. These reports also address the possibility of alternatives to CFC's in foam manufacturing. An international panel of experts was convened to advise EPA on possible chemical substitutes for the suspect ozone-depleting CFC's as well as on means of advancing commercialization of such substitutes.

A project will be initiated in 1988 to examine the properties of proposed alternative compounds, with regard to their suitability as possible replacements for the ozone-depleting fullyhalogenated CFC's and halons currently used as refrigerants, foam blowing agents, solvents, and fire extinguishants. Engineering studies will continue that evaluate process modification technologies to reduce CFC emissions, add-on controls to collect and recycle emissions and to destroy CFC's.

Scientific Support for the Global Warming Program

In 1987, EPA established a program to address the causes and effects of global climate change. Workshops were held with experts from around the country to provide a sound foundation for the development of a long-range global climate change research plan.

C. ACID DEPOSITION RESEARCH ACTIVITIES

Acid Deposition - General

Research on acid deposition is coordinated through EPA's National Acid Precipitation Assessment Program (NAPAP), which is administered by the Interagency Task Force on Acid Precipitation. The term "acid rain" means the atmospheric deposition of acidic or acid forming compounds in either dry or wet form. These compounds exist in the atmosphere as gases or aerosol particles containing sulfur oxides, nitrogen oxides, hydrogen chloride, sulfuric acid, nitric acid, and certain sulfate and nitrate compounds. The objective of acid deposition research is to develop necessary data to fully understand the sources and characteristics of acid deposition, the extent of damage or potential damage, and the corrective measures that may be used to diminish the problem.

In 1987, acid deposition research produced scientific information on the chemical status of a representative sample of lakes in the eastern United States, and developed a preliminary 1985 man-made emissions data base. The program established a cloud chemistry network to cover the major high altitude forest system in the eastern part of the nation. A deposition monitoring network was installed. Significant progress was made in determining the effects of acidic deposition on southern conifer and spruce/fir forests.

Long-term Deposition Monitoring Data (Both Wet and Dry) to Provide Trends Analyses, Evaluate Atmospheric Models, and Determine Exposure in Effects Studies

In 1987, the deposition monitoring research program continued to provide the deposition data on wet precipitation through the National Trends Network (NTN). The network, consisting of 150 stations, operated at full capacity. Data reports covering the first four years of operation of the deposition network were published.[86-87] A report was produced which analyzed the wet deposition network design and seasonal trends.[88]

Several advances were made in dry deposition research. A siting plan for dry deposition in the West was developed and approved. A report was published which detailed the results of a siting study in the Southeast.[89] Another report was published which describes interim annual estimates of eastern dry deposition.[90]

Activities to Improve the Scientific Understanding of Atmospheric Processes

In 1987, the first generation Regional Acid Deposition Model (RADM I) was evaluated against data collection during Oxidation and Scavenging Characteristics of April Rains (OSCAR) and the First GARP Global Experiment (FGGE). This version of the RADM was used to develop dry deposition estimates for the Direct Delayed Response Program models.

An extensive review of the RADM I was conducted in May 1987, and improvement to the gas phase chemistry and scavenging module were recommended. The improved gas phase module was completed by November as part of a second generation version of RADM, RADM II. The RADM Scavenging Model (RSM) was delivered in October. Because of the increased computer time required to run the RADM with the RSM when it was first delivered, two versions of RADM II were configured; a full "scientific" version (RADM IIS) incorporating the RSM, and an "applications" version (RADM IIA), which utilizes a simpler scavenging model with consequent reduced computer time.

A sulfur-only "engineering" version of RADM I, called the Engineering Model (EM), was also completed in 1987. Although no longer intended for use as an assessment version of RADM, the EM still can be used to provide insight into source attribution.

A scheme to aggregate selected runs of RADM II to provide seasonal and annual estimates of wet and dry deposition has been developed. Included in this methodology is an estimate of the error of the long-term deposition. Once completed, this methodology is expected to be applied to policy assessment activities using the RADM IIA.

Planning for the model evaluation field study continued during 1987. A contract was awarded to install the ME-35 surface network, and to plan and implement the diagnostic evaluations using aircraft during field investigations. Preliminary plans for the diagnostic evaluations were developed. An agreement was reached with the Federal Republic of Germany to have the Hawker-Sidley research aircraft from the Fraunhofer Institute participate in the field intensives in 1988.

The International Sulfur Deposition Model Evaluation (ISDME) report was completed. Further improvements on one of the models used in this report, the Regional Lagrangian Model of Air Pollution (RELMAP), was used to develop dry deposition estimates as part of an EPA staff paper on the state of science of acid deposition. Further improvements have subsequently been made to the model to represent boundary layer processes more realistically.

Activities to Improve the Scientific Understanding of the Aquatic Effects of Acid Deposition on Surface Waters Watersheds, and Aquatic Biota

Acid deposition is believed to be a major contributor to chronic depressions in aquatic systems. Effects which may result include effects on fish and other aquatic organisms and drinking water quality. The population-at-risk of surface waters and aquatic biota in the United States is only partially known. Improvements are needed in both the scientific understanding and: (1) the current status of surface waters and watersheds including episodes, (2) the chemical and biological changes to those resources, and (3) the rate of change resulting from current and altered loadings of acidic or neutralizing substances. These improvements will allow the development of more scientifically acceptable, yet simplified relationships and models for assessment and policy needs.

The rate of change of systems is being investigated by the Direct/Delayed Response Project. Three different levels of modeling activities will supply target loading predictions by region. Verification of prediction of the Direct/Delayed Response Project will be undertaken by field and pilot level manipulations of watersheds as part of the Watershed Manipulation Project. The research plan for this project was developed and reviewed in 1986; manipulation trials began in 1987.

Long-term monitoring provides the ultimate verification of model predictions by producing information on water quality trends, especially in sensitive systems. The Temporally Integrated Monitoring of Ecosystems (TIME) Project is being designed based on the results of the NSWS to maximize its applicability to detecting changes in sensitive surface waters.

Activities to Improve the Scientific Understanding of the Terrestrial Effects of Acid Deposition on Forests, Soil, and Watersheds

Various adverse changes in forest conditions have been observed in the United States since the early 1980's. Increased forest mortality has been observed in high elevation stands of red spruce and balsam fir. There is some indication that annual growth is reduced in these stands. These observed symptoms are nonspecific and could be caused by several different factors or combinations of factors. Acidic deposition and its associated pollutants have been implicated as causal factors.

A joint EPA/U.S. Forest Service research program, the Forest Response Program (FRP), was established in 1986 to investigate: (1) extent of damage to forest ecosystems which might be caused by acid deposition, (2) cause and effect relationships, and (3) dose response relationships. During 1985 and 1986, the FRP established the Spruce-Fir, Southern Commercial, Eastern Hardwoods, and Western Conifer research cooperatives. Also, the National Vegetation Survey was implemented and a Synthesis and Integration Team has been established. Research continues in all of these activities.

Spruce-Fir Research Cooperative - This cooperative addresses the question of extent of forest damage and investigates most of the major hypotheses of cause and effect related to the impact of atmospheric deposition on Northeastern spruce-fir and Appalachian spruce-fir.

Southern Commercial Forest Research Cooperative - The Southern Commercial Cooperative is investigating the physiology of southern pine species (principally loblolly) in relation to air pollutants in the laboratory and "intensive" field research sites.

Eastern Hardwood Research Cooperative - The Eastern Hardwood Cooperative has concentrated on the spatial extent and temporal development of adverse changes in forest condition in eastern hardwood species, including sugar maple. Also included are studies concerning the effects of atmospheric deposition on physiological and nutritional processes.

Western Conifers Research Cooperative - Similar to Eastern Hardwood, the thrust of this cooperative is problem definition. Western conifer forests are diverse and subject to pollutant stresses on both a local and regional basis.

National Vegetation Survey - Projects undertaken by the National Vegetation Survey explore the questions of the temporal development and spatial extent of changes in forest condition. These include analysis of available data, field observations, and studies along known deposition gradients.

Synthesis and Integration - The Synthesis and Integration Project plans, tracks, and summarizes Forest Response Program research. Data management and modeling assist the scientific assessment of air pollution effects on forests.

Activities to Improve the Scientific Understanding of the Effects of Acid Deposition on Materials

The materials effects research program is directed toward understanding the quantitative relationships between the various forms of acidic deposition and the resulting damage rates to materials and identifying the geographical extent of materials-at-risk. As a result of major program and project review conducted with NAPAP, the materials research program was reconstructed in 1986. A major initiative was the development of a research program to determine the effects of acid deposition on paint/substrate systems. In 1987 a peer reviewed paint research plan was produced.[91]

A preliminary physico-chemical model of acid deposition on galvanized steel was prepared. This demonstrated the ability to predict damage in the field from information gathered in the laboratory. Additional laboratory and field studies are being conducted to refine and test the model. Field studies on other common metals are in progress at five materials exposure sites. Initial results of the field study were published that indicate the sensitivity of metal surfaces to acid deposition changes over time as a corrosion layer is formed. This has led to the development of a model of deterioration based on the formation of a carbonate layer as a rate-controlling step in deposition.

Provision of Additional Information to Document the Reliability and Cost-Effectiveness of the Limestone Injection Multistage Burner (LIMB) Control Technology to Reduce Sulfur Oxides and Nitrogen Oxides

The EPA continues to develop LIMB technology that is designed to reduce emissions of both sulfur oxides and nitrogen oxides, the two major acid deposition precursors. The LIMB emission reduction technology is designed to be retrofitable to both large and small existing coal-fired boilers.

In 1987, work continued on the development of high surface area sorbents and sorbents treated with "promoters" to improve the sulfur capture ability of the LIMB technology. Also, EPA continued the laboratory and pilot-scale research of the LIMB process to improve engineering knowledge of the effects of operating parameters and systems variables associated with nitrogen oxides control and sulfur dioxide capture. The wall-fired LIMB demonstration was started and removal objectives for SO_2 and NO_x were initially met. A contract was awarded for the tangentially-fired boiler demonstration.

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IV. DEVELOPMENT OF NATIONAL AMBIENT AIR QUALITY STANDARDS

A. DESCRIPTION OF ACTIVITIES

The 1977 Clean Air Act Amendments require EPA regularly to review and, if appropriate, to revise all of the national ambient air quality standards. The review of the particulate matter air quality standard was completed in 1987 and reviews of other standards were in process.

On July 1, 1987, EPA promulgated revisions to the air quality standard for particulate matter[1]. The revised standard replaced total suspended particulate matter (TSP) as the indicator for particulate matter for ambient standards with a new one that includes only those particles less than or equal to 10 micrometers in diameter (PM_{10}) and replaced the 24-hour primary TSP standard with a 24-hour PM_{10} standard of 150 micrograms per cubic meter with no more than one expected exceedance per year. In addition, the revised standards replaced the annual primary TSP standard with an annual PM_{10} standard of 50 micrograms per cubic meter expected annual arithmetic mean, and replaced the secondary TSP standard with 24-hour and annual PM_{10} standards that are identical to the primary standards in all respects. The July 1 notice also announced a new reference method for measuring PM_{10} in the ambient air as well as final regulations concerning ambient air monitoring reference and equivalent methods, ambient air quality surveillance, and implementation requirements.

Also on July 1, 1987, EPA published an advance notice of proposed rulemaking soliciting public comment regarding the development of a new secondary ambient air quality standard for fine particles (those particles less than 2.5 micrometers in aerodynamic diameter)[2]. This action represents a continuation of the review process for secondary standards for particulate matter. This secondary standard would address regional haze conditions associated with elevated levels of fine particles. The notice specifically asked for comment on the regional character of visibility, determination of adverse effects, pollutant/visibility/source-receptor relationships, and timing of standards development with respect to acid deposition strategies. The public comment period on the advance notice closed on September 29, 1987. (For related information on visibility protection, see Chapter VI, Section A, Visibility Protection in Federal Class I Areas.)

In April 1986, the Clean Air Scientific Advisory Committee (CASAC) reviewed a revised draft of the ozone criteria document and the first draft of the ozone staff paper. The CASAC completed its review of the criteria document in October 1986. At a December 1987 meeting, CASAC reviewed a revised staff paper and a research summary of more recent studies. Issues were discussed regarding the existing 1-hour standard and the possible need for new longer-term standards to protect against chronic health and welfare effects. At the conclusion of this session CASAC did not feel the group had reached a point where it was adequately prepared to articulate and communicate its recommendations to the EPA Administrator and thus it called for an additional meeting in 1988. The CASAC plans to make recommendations to EPA following this meeting.

Reviews of the carbon monoxide and nitrogen dioxide air quality standards were completed in 1985. The EPA began the process of preparing a new criteria document for carbon monoxide in 1987. The EPA is following several ongoing studies of the health effects of carbon monoxide, including a major study which should better identify the relationship between carbon monoxide and possible aggravation of pre-existing cardiovascular disease. Results from this study are expected to be released in 1988. An external review draft of the revised criteria document is also scheduled to be available for public review in 1988. Development of the criteria document for nitrogen dioxide will be initiated in 1989.

Activities related to the review of the sulfur oxides air quality standard in 1987 focused on completing the staff paper addendum[3] and the development of a regulatory package. The CASAC reviewed a draft of the addendum in October 1986 and submitted its closure letter in February 1987. The EPA anticipates announcing a proposed decision on whether to reaffirm or revise the standards in 1988.

With respect to the review of the ambient standard for lead, activities focused on updating and validating the lead exposure methodology. It is anticipated that CASAC will review a revised draft of the staff paper in 1988.

Also during 1987, EPA prepared a draft document entitled "Acid Aerosols Issues Paper" which assesses the available scientific and technical information on the health effects of acid aerosols and identifies critical research needs. The draft paper will be reviewed by CASAC in early 1988.

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V. ASSESSMENT AND CONTROL OF TOXIC AIR POLLUTANTS

A. INTRODUCTION

In 1985, EPA announced its strategy for the control of both routine and accidental releases of toxic air pollutants.[1] The following sections discuss the activities and progress made in 1987 to implement this strategy.

B. ASSESSMENT AND REGULATORY DECISIONS

In 1987, EPA continued to implement an active program to screen and assess potentially toxic air pollutants for possible regulation under the Clean Air Act or other environmental authorities. As shown in Table V-1, 34 chemicals or emission mixtures were in various stages of assessment at the end of 1987. Decisions not to pursue a regulatory program directed specifically at copper[2] and zinc and zinc oxide[3] were published in 1987. Decisions on whether to regulate 5-10 additional pollutants are expected in 1988.

In 1987, final efforts were completed for a report to Congress on the National Dioxin Study, which was a coordinated effort of various EPA programs to assess the potential extent of contamination of the environment with chlorinated dioxin compounds. Air related activities were centered in Tier 4 of the study,[4] which primarily addressed combustion sources and emissions to the atmosphere. In addition to the report to Congress, other supporting technical reports have been published which address engineering and air quality data analysis.

In June 1987, EPA also published a report to Congress on municipal waste combustors (MWC).[5] The report addresses EPA's preliminary assessment of the multi-media aspects of MWC, including releases to the air of dioxins, furans, acid gas, and hydrocarbons as well as traditional air pollutants. Based on the results of this study, EPA published an advance notice of proposed rulemaking in July 1987 that announced its intent to regulate municipal waste combustion under sections 111(b) and 111(d) of the Clean Air Act.[6]

C. FEDERAL REGULATORY PROGRAM - STATIONARY SOURCES

1. National Emission Standards for Hazardous Air Pollutants (NESHAP)

° Vinyl Chloride - In July 1987, the U.S. Court of Appeals for the District of Columbia Circuit vacated EPA's 1985 withdrawal of a proposed revision of the NESHAP for vinyl chloride. In remanding the standard to EPA for reconsideration, the court held that EPA had not shown that the vinyl chloride standard adequately protects public health within the meaning of Section 112 of the Clean Air Act. The EPA is in the process of considering how to respond to the remand.

- Benzene - In June 1984, EPA promulgated a NESHAP for benzene equipment leaks and withdrew proposed NESHAP for benzene emissions from maleic anhydride plants, ethylbenzene/styrene plants, and benzene storage tanks. Following the vinyl chloride decision, EPA voluntarily accepted a remand of the benzene NESHAP to reconsider the three withdrawn benzene proposals and the benzene fugitive NESHAP. Final action on the remand is expected to be published in 1989. In addition, work continued in 1987 on a NESHAP for coke oven by-product plants.

- Asbestos - Work continued on revising the asbestos NESHAP during 1987. The revision will cover the demolition and renovation provisions and monitoring requirements for several other source categories.

- Mercury - A revision to the mercury NESHAP was promulgated in 1987.[7]

- Chromium - During 1987, NESHAP development continued for chromium emissions from electroplating and industrial cooling towers. Regulations to prohibit the use of chromium in comfort cooling towers are being considered under the authority of the Toxic Substances Control Act. Other chromium sources still under consideration for NESHAP include utility boilers, industrial boilers, chromium chemical manufacturing, steel production, refractory manufacturing, sewage sludge incinerators, municipal incinerators, cement manufacturing, chromite ore refining, and ferrochromium production.

- Coke oven emissions - A proposed NESHAP for coke oven emissions[8] was published in 1987. A supplemental proposal will be published in 1989 to reevaluate the proposed standard consistent with the above-mentioned court decision on vinyl chloride.

- Ethylene Oxide - Work continued in 1987 on a NESHAP for commercial sterilization chambers.

- Hazardous Organic NESHAP (HON) - The HON is an accelerated NESHAP development effort that will cover eight organic compounds (ethylene oxide, methylene chloride, ethylene dichloride, perchloroethylene, trichloroethylene, butadiene, chloroform, and carbon tetrachloride) for which intentions to list under section 112 of the Clean Air Act have been published. The HON will cover 13 source categories in the organic chemicals industry. Publication of a proposed rule is scheduled for 1988.

- Perchloroethylene - A decision to propose a NESHAP for control of perchloroethylene emissions from drycleaning industry sources resulted from an EPA precedent-setting effort to integrate cross-media analyses of health and environmental exposure risks associated with chlorinated solvents. This analysis was conducted as part of an Interagency Chlorinated Solvents investigation in which EPA decided to first look at the total risk potential and then to consider what regulatory controls would be appropriate and under what statutory authority. The EPA is proceeding with development of a NESHAP for control of perchloroethylene emissions from drycleaning industry sources.

- Radionuclides - EPA also requested a voluntary remand of all radionuclide NESHAP and is presently working to repropose regulatory decisions for 12 source categories: Nuclear Regulatory Commission (NRC)-licensees, Department of Energy (DOE) facilities, radon emissions from DOE facilities, high-level waste facilities, uranium fuel cycle facilities, elemental phosphorus plants, coal fired boilers, underground uranium mines, open pit uranium mines, phosphogypsum piles, active mill tailing piles and disposed mill tailings. In the past, the EPA has decided not to promulgate NESHAP for radon emissions from DOE facilities, high-level waste facilities, uranium fuel cycle facilities, open pit uranium mines and phosphogypsum piles. As part of the repromulgation process EPA will reconsider whether NESHAP are necessary for all or some of these source categories.

Also in the area of radiation, EPA's air program began development in 1987 of a regulation to control the disposal of low level radioactive waste under the authority of the Toxic Substitutes Control Act (TSCA).

° Solvent Degreasing - Work continued in 1987 on a NESHAP for solvent degreasing equipment. The NESHAP will address emissions of perchloroethylene, trichloroethylene, and methylene chloride.

° Cadmium - Decisions on which source categories of cadmium warrant regulation are still under consideration. The categories under consideration are primary cadmium smelters, lead smelters, copper smelters, pigments manufacturing, stabilizers manufacturing, and zinc and zinc oxides production.

° Municipal Waste Combustors - A detailed risk and control technology assessment was published in 1987. As a result, EPA issued a notice in the Federal Register that announced its intent to regulate emissions from new and modified municipal waste combustors using new source performance standards.[9] Pollutants to be regulated are expected to include one or more designated pollutants (pollutants not regulated under sections 108-110 or 112) thus invoking section 111(d) of the Clean Air Act which would require States to develop additional emissions standards for existing municipal waste combustors units.

° Municipal Landfills - Work commenced in 1987 on a rule to regulate emissions from new and modified municipal landfills using new source performance standards. Pollutants to be regulated are expected to include one or more designated pollutants thus invoking section 111(d) of the Clean Air Act. Section 111(d) would require States to develop emission standards for existing landfills. Pollutants of concern include volatile organic compounds and a number of toxic compounds (e.g. methylene chloride, vinyl chloride, and benzene).

2. Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)

In November 1984, the Resource Conservation and Recovery Act (RCRA) was reauthorized. Section 3004(n) of the reauthorization requires EPA to promulgate such regulations for the monitoring and control of air emissions at hazardous waste TSDF's as may be necessary to protect human health and the environment. Air emission sources of concern include surface impoundments, landfills, land treatment units, waste piles, wastewater treatment systems, pretreatment units, and transfer, storage and handling operations. The number of TSDF facilities is currently estimated at between 2,000 - 3,000.

Preliminary assessments of the industry show that TSDF's may pose significant health and environmental risks to the air. Emissions of volatile organic compounds (VOC's), which lead to ozone formation, may be as high as 10 percent of the total nationwide VOC emissions. In addition, cancer incidence from toxic compounds may be as high as 140 cases per year. There is a great deal of uncertainty in these estimates, and a better understanding will be gained over the course of the regulatory development process.

Current plans call for development of TSDF regulations in three phases:

° The first group of standards addresses sources for which EPA can develop standards relatively quickly because similar sources have already been regulated under the Clean Air Act. These standards address air emission vent and fugitive emissions from some of the treatment devices that will be used to meet the RCRA land disposal restrictions. The standards were proposed in 1987.[10]

° The second group of standards, which addresses the bulk of the TSDF sources, is scheduled for proposal in 1989. The sources to be included in this proposal are landfills, surface impoundments, land treatment, pretreatment, waste piles, wastewater treatment tanks, and transfer, storage, and handling facilities.

° The third group of regulations will cover certain subsets of the seven TSDF source categories for which EPA will likely be unable to develop rules during the second round. These may include dewatering devices (belt presses, filter presses, and centrifuges) and waste fixation in the pretreatment source category and operations associated with containers (filling, emptying, cleaning, etc.). Less data exist on these sources to quantify the extent of the problem or to address the solution. In addition, the land ban rules being developed under other sections of RCRA will require treatment before disposal of hazardous wastes. This program is expected to cause major shifts in the TSDF industry and could cause new sources of air pollution which need to be addressed as the industry develops new treatment technologies. Work on the third group of TSDF's is expected to begin in 1989.

D. MOBILE SOURCES

(Mobile source activities related to air toxics are described in Chapter IX of this report.)

E. SPECIFIC POINT SOURCES

In 1987, EPA continued to pursue that portion of its overall strategy to control emissions of air toxics that provides State and local air pollution control agencies with funding and technical support to evaluate specific point sources. Sources that are candidates for this program include those that have been identified through the Federal toxic air pollutant assessment program as well as those certified by State and local air pollution control agencies. This program was initiated in 1984 with a pilot program involving the chemical acrylonitrile, a carcinogen for which the public health risks are limited due to the existence of only a limited number of industrial facilities. As previously reported, evaluations involving all 26 acrylonitrile facilities in 14 States have been completed and the reports accepted by the appropriate State and local agencies. Additional control will be achieved at 15 of the 26 facilities, with total acrylonitrile emissions being reduced by 50 percent after all controls are implemented. In addition, maximum risk to the most exposed individual will be reduced by 60 percent, and the predicted cancer incidence is expected to decrease by 66 percent.

In 1987, funding was provided for 22 State and local agency evaluations of potential high risk point sources in a variety of source categories. This program is expected to proceed like the one for acrylonitrile, but in a less formal way. In selecting these facilities for inclusion in the program, a variety of factors was considered, including the magnitude of the perceived risk, the likelihood of further air toxics program development, the availability of resources, the potential for overlap with other programs, and the national applicability of the reported findings.

In 1988, additional guidance will be provided to State and local control agencies on how to identify and evaluate high risk point sources. The guidance will incorporate knowledge gained from the acrylonitrile efforts and the additional source evaluations begun in 1987. State and local agencies will then screen a reasonable number of candidate high risk point sources in order to take appropriate follow-up action.

F. ASSESSING URBAN RISK

In 1986, EPA initiated planning activities to encourage States to undertake new efforts toward assessing the scope and seriousness of current exposures to mixtures of air toxic compounds which are believed commonplace in large metropolitan areas. The EPA provided funds under section 105 of the Clean Air Act and technical assistance to States to encourage them to undertake such assessment efforts in a number of areas. Initially, 30 areas with populations over one million people were targeted for some level of assessment. State-initiated efforts included ambient monitoring, source/emission inventory analyses, and risk assessment activities to help determine whether such problems indeed exist and, if so, how serious they are.

In 1987, available funds were provided to States through EPA Regional Offices, technical guidance was developed and distributed, and available opportunities were utilized to provide evidence of the existence of the problem and promotion of assessment programs. As a result of these activities and of independent actions on the part of State and local agencies, several activities have been initiated and in many cases have progressed to an advanced stage. For example, nineteen toxic air quality sampling sites in eighteen urban areas are now collecting data as part of EPA's Urban Air Toxics Sampling Program. Many areas are inventorying toxic air pollutant emissions and several have initiated or completed major studies aimed at assessing urban air toxics impacts and risks.

In addition, activity on several Integrated Environmental Management Projects (IEMP) was continued. These projects, while multimedia in nature, focus a major portion of study on the air toxics aspects of the urban environment. The Kanawha Valley (West Virginia) Phase I study has been concluded and sampling is well advanced in the Denver IEMP Study. Separate efforts in areas such as Staten Island, New York will provide further assessments of the problem. Such work is expected to result in some determination of what mitigation activities might be warranted. In addition, a large local program was also completed in the Los Angeles, California area.

The EPA also distributed additional guidance in 1987 on procedures for estimating air emissions for selected potentially toxic pollutants. Final reports were distributed for benzene and storage tanks and a compilation of emission factors for air toxics compounds was prepared. Other emission estimation reports are now in review for municipal incinerators and sewage sludge incinerators. These documents are scheduled for publication in 1988. Additional work includes development of improved emission factors for various area sources of toxic air pollutants and guidance for developing emission inventories for air toxics.

G. BUILDING STATE AND LOCAL AIR TOXICS CONTROL PROGRAMS

The EPA has established a goal to have quality programs in every State and major local agency that are adequate to carry out certain roles envisioned within the national air toxics strategy. These roles are: (1) accepting delegation and enforcing NESHAP, (2) identifying , evaluating, and mitigating (as necessary) point sources of local concern not addressed by NESHAP, (3) addressing urban problems arising from complex multisource, multipollutant interactions, and (4) enhancing program capabilities to conduct applicable activities in the first three areas and to facilitate implementation of other programs specific to the needs of each State or community.

During 1987, considerable progress was made toward meeting this goal. The progress was in part due to EPA's program to enhance State and local program development. This program uses available grant funds to promote multiyear planning on the part of State and local agencies and subsequent implementation of these plans for building their air toxics capabilities and programs. Within a multiyear development plan, State and local agencies were encouraged to develop and conduct the above-mentioned activities related to EPA's national strategy. In response, EPA has now received about 70 multiyear development plans from 49 States and 21 local agencies. The major emphasis of the current State and local activities within these plans varies. Most, however, focus on development of toxic emissions inventories and modifying existing new source review permit systems to incorporate consideration of air toxic concerns. Other State and local agencies are actively developing more comprehensive regulations to address both new and existing sources while a few are actually implementing such programs. In all, the amount of State and local program development has about doubled since 1983.

To assist in implementation of multiyear development plan activities, EPA expanded its program of technical support in 1987. First, EPA continued its practice of developing and distributing technical assistance documents for assisting State and local agencies in estimating air toxics emissions. A series of documents on locating and estimating emissions of various air toxic pollutants (or sources) now covers sixteen pollutants with the release of reports on polycyclic organics and polychlorinated biphenyls in 1987. Documents on benzene, storage tanks, and municipal and sewage sludge incinerators will be distributed in 1988. A compilation of toxic air pollutants was distributed in 1987 and is being expanded and improved for release again in 1988. Other documents designed to assist State and local agencies, including a guide for associating source categories with various pollutants and a compilation of air toxics questionnaires, will be released in 1988. Next, EPA's Control Technology Center (CTC) became fully operational (see below) in 1987 and activities of the National Air Toxics Information Clearinghouse were also continued (see below). Finally, a series of national workshops were conducted to assist State and local agencies in the basic aspects of program development and implementation. These workshops were conducted by EPA in conjunction with the State and Territorial Air Pollution Program Administrators (STAPPA) and the Association of Local Air Pollution Control Officials (ALAPCO). The workshops were well-attended and were cited by State and local agencies as a successful example of how they were able to work cooperatively with EPA.

In 1987, EPA continued to operate and improve the National Air Toxics Information Clearinghouse (NATICH). The most significant improvement was the development of a system to allow State and local agency personnel to add or revise data for their agency in the NATICH computer files electronically rather than by hard copy reporting. Established in 1983, the Clearinghouse provides a tangible method of improving communication among EPA and State and local agencies. The Clearinghouse is funded by EPA and is a cooperative effort among EPA, STAPPA and ALAPCO. The goal of the Clearinghouse is to disseminate information about activities under way to solve toxic air pollutant problems and to reduce duplication of effort. Some of the kinds of information included in the Clearinghouse are: (1) regulatory program activities including the status and scope of air toxics control programs and state-adopted acceptable ambient levels; (2) source permit data, including the number of air toxics permits issued by an agency, site-specific permit data, pollutant-specific emission limits, and required control technology; (3) source test data, including quantities of pollutants emitted from specific sites and sampling and analytical techniques used; (4) ambient monitoring methods in use; (5) bibliographic citations for reports and Federal Register notices related to air toxics; (6) ongoing research and regulatory development activity descriptions; (7) emissions inventory information; and (8) selected EPA risk assessment results. With the implementation of the NATICH data base, the Clearinghouse users (e.g., State and local air quality management agencies, EPA, industry, environmental groups, and the public) may now have direct access to the Clearinghouse information through interactive programs. In addition to direct computer access to the data base, hardcopy reports[11,12,13] of the data base information are printed and distributed annually. Other Clearinghouse publications distributed in 1987 include four issues of the Newsletter and a special report on qualitative and quantitative cancer risk assessment[14]. Plans for 1988 include continuation of the prior publications, publication of a special report on risk communication and updates of users' guides, increasing publication of the Clearinghouse Newsletter to six issues, and streamlining the on-line data base.

The CTC completed its first year of operation in 1987. The CTC supports the implementation of State and local programs by providing technical assistance and support on air pollution control technology. While the major portion of the CTC's assistance efforts in 1987 have been related to air toxics, the CTC is designed to respond to control problems for criteria pollutants as well. The CTC provides three levels of assistance:

1. Hotline. The CTC Hotline provides an initial, rapid response based on information available immediately from EPA staff and contractors. In 1987, the hotline responded to over 200 requests from State and local agencies.

2. Engineering Assistance. In some cases, it is appropriate to go beyond the rapid response level of support and provide more detailed engineering assistance. Assistance may include engineering analysis and on-site support tailored for each situation. In 1987, the CTC provided direct engineering assistance to three States. In each case, a State or EPA Regional Office had requested support in resolving technical issues involved with regulations development or permitting.

3. Technical Guidance. The third level of support involves programs to transfer available technical information on state-of-the art pollution controls to State and local agencies. Guidance prepared by the CTC focuses on current topics of national interest that come apparent through contact with control agencies. In 1987, the CTC published and distributed a document on the control of toxic and organic emissions from air stripping towers.[15] In addition, work was under way in 1987 on a series of workshops for State and local agencies on permitting toxic air pollution sources and on personal computer-based software to help evaluate applications for operating permits for air toxics. Both of these products will be available in 1988.

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TABLE V-1. TOXIC AIR POLLUTANT EVALUATION AND CONTROL PROGRAM[1]

Preliminary Health & Source Screening	Detailed Assessment	Intent-to-List §112	Decision not to Regulate	Listed Under §112[4]	NESHAP Proposed	NESHAP Promulgated
Propylene	Chlorine & HCl	Chromium[5]	Toluene	Asbestos	Benzene	Mercury
Propylene oxide	Phosgene	Carbon tetrachloride	POM	Beryllium	Coke oven emissions	Beryllium
Ammonia	Acetaldehyde	Ethylene oxide	CFC-113	Vinyl chloride		Asbestos
Styrene	Acrolein	Chloroform	Methyl chloroform	Coke oven emissions		Vinyl chloride
Xylenes	Hydrogen sulfide	Ethylene dichloride	Manganese	Benzene		Benzene
Ethyl chloride	Beryllium[2]	Cadmium	Chlorobenzenes	Arsenic		Radionuclides
Methyl methacrylate	Dibenzofurans	1-3-Butadiene	Vinylidene chloride	Radionuclides		Arsenic
Maleic anhydride	Asbestos[2]	Methylene chloride	Hexachlorocyclopentadiene	Mercury		
Phthalic anhydride	Dioxins	Perchloroethylene	Chloroprene			
Hydrogen fluoride	Formaldehyde	Trichloroethylene	Acrylonitrile[3]			
Phosphorus	Toluene diisocyanate		Nickel			
Sodium hydroxide	Methyl isocyanate		Phenol			
Hydrocyanic acid	Mineral fibers		Copper			
Selenium & compounds	Epichlorohydrin[5]		Zinc/Zinc oxide			
Mercuric chloride			Naphthalene			
Bromine & inorganic compounds			Epichlorohydrin			
Dimethylamine						
Methanol						
Contaminant asbestos						

[1] As of December 31, 1987.

[2] Reassessment of original health effects information.

[3] Referred to States for evaluation.

[4] EPA is also regulating wood stove emissions and municipal waste combustor emissions under section 111 (New Source Performance Standards) which will significantly reduce the toxic components of these emissions. Onboard controls for gasoline vapors from vehicle refueling are being developed under Title II of the CAA.

[5] Reassessment for short-term health effects.

VI. STATUS OF AIR QUALITY MANAGEMENT PROGRAMS

A. DEVELOPMENT OF POLICY AND REGULATIONS

Particulate Matter Implementation Policy and Guidance

On July 1, 1987, in conjunction with the promulgation of the revised national ambient air quality standard, EPA published revised particulate matter implementation and monitoring regulations and guidelines.[1] The regulations require the States to revise their implementation plans to attain and maintain the new standards for ambient particulate matter in the size range of 10 micrometers and smaller (PM_{10}). However, due to a lack of current PM_{10} data, EPA used other particulate matter data to determine which areas would be required to develop new control strategies to attain the revised standards. Since these data were not directly correlatable to PM_{10}, EPA developed a probability guideline to relate the data to PM_{10}. Using the probability guideline and other information, EPA classified all areas of the country as Group I, II, or III. On August 7, 1987, EPA published a list of 68 counties (or parts of counties) which were classified as Group I or as having a high probability of violating the PM_{10} standards, and a list of 112 counties which are Group II or where the data are inconclusive.[2] The rest of the country was classified as Group III or having a high probability of attaining the PM_{10} standards. For the Group I areas, EPA's policy called upon the States to immediately revise their particulate matter State implementation plans (SIP's) to include new control strategies and emission limitations which will result in attainment of the PM_{10} air quality standards. For the Group II areas, EPA's policy called for intensive monitoring to determine if the area is attaining the PM_{10} standards. If violations of the PM_{10} standards are observed, the States were to revise their SIP's to attain the standards. For Group III areas, EPA presumed that the existing particulate matter control program was adequate to attain and maintain the PM_{10} standards. All States, however, regardless of the group to which they belonged, were to revise their SIP's to ensure they contain appropriate definitions of the pollutants being regulated and that the definitions include PM_{10}, to revise their emergency episode plans to meet the new significant harm level, to incorporate PM_{10} into their new source review procedures, and to meet new monitoring requirements.

While EPA revised the new source review requirements to include PM_{10}, it also retained the statutory prevention of significant deterioration (PSD) increments which prevent significant deterioration of particulate matter air quality measured as total suspended particulate (TSP). The EPA acted in this way to maintain a PSD program for particulate matter during the time required to develop new PSD increments for PM_{10}. One result of this decision is that two different indicators of particulate matter, PM_{10} and TSP, will be regulated as an interim approach to controlling emissions from new source construction. The EPA's objective is to develop new PM_{10} increments that will prevent significant air quality deterioration so that the PM_{10} increments can be used by State and local air pollution control agencies in lieu of the TSP increments. Promulgation of PSD increments for PM_{10} is currently scheduled for 1989.

In the April 1985 proposal of its PM_{10} implementation regulations, EPA proposed to continue its existing rural fugitive dust policy. The EPA received significant negative comment on that proposal. Therefore, on July 1, 1987, EPA solicited comment on the need for such a policy and on three alternatives to the existing policy[3]. The alternatives differ on the priority given to attaining either the 24-hour or annual PM_{10} standards. The EPA also requested comment on its definition of the rural fugitive dust area to which the rural fugitive dust policy applies. On September 30, 1987, EPA closed the comment period on the proposal.

Post-1987 Ozone/Carbon Monoxide Policy

Over the past 2 years, EPA has been considering how it should deal with the continuing violations of the national ambient air quality standards for ozone and carbon monoxide in many urbanized areas across the country. The latest date for attainment mentioned in the Clean Air Act was December 31, 1987, and it is apparent that many areas have not been able to meet this deadline. By the end of 1987, law suits to compel EPA to promulgate Federal implementation plans were pending for Los Angeles, Sacramento, and Ventura County, California, and for the Chicago metropolitan area.

Since 1970, most of these areas have gone through several rounds of planning for attainment of these standards, first as a result of the 1970 Clean Air Act and next under the 1977 Amendments to the Act. Each round has produced new State implementation plans that in turn have produced significant progress toward controlling the emissions of pollutants that cause violations of the standards. Despite all of the progress, however, it is quite clear that the present SIP's in in many areas cannot bring attainment and need to be tightened, in many cases substantially, to produce attainment. The EPA estimates that at least 50 areas, mostly larger metropolitan areas, will have failed to meet the standards for either ozone or carbon monoxide, or both, by December 31, 1987. The EPA is waiting to compile the 1987 air quality data before making final determinations.

Because of the imminent final attainment date of December 31, 1987, EPA began 2 years ago to develop a policy for dealing with the likely nonattainment of a large number of large urbanized areas. The Act does not provide explicit direction on how to handle these "post-1987" situations although EPA believes that the Act does provide some guidance. For that reason, EPA began to develop a policy to guide State and local planners in a new round of planning. EPA proposed its post-1987 policy in the Federal Register on November 24, 1987.[4] The proposed strategy incorporates the kinds of measures that can be implemented by Federal, State, and local governments. It lays out flexible deadlines that cities and States can meet through careful planning and determined implementation. It includes sanctions against areas that fail to make adequate progress and areas that fail to develop plans that demonstrate attainment within a near-term, fixed attainment date. It would prohibit construction of major new facilities if attainment of the standards is not projected within 3 or 5 years of EPA's approval of required new State implementation plans.

The EPA intends to evaluate the 1987 air quality data and to begin to issue calls for new State implementation plans in 1988. States would have 2 years to develop their plans, although certain commitments would be needed soon after the SIP calls. Major planning reviews would also be required at specified intervals to ensure development of the plan.

Visibility Protection in Federal Class I Areas

Section 169A of the Clean Air Act establishes as a national goal "the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class I Federal areas which impairment results from manmade air pollution." On December 2, 1980, EPA promulgated regulations implementing this section.[5] All States which contained mandatory Class I Federal areas were to develop and submit SIP revisions to EPA which implemented these regulations.

On December 20, 1982, a number of plaintiffs filed suit in the United States District Court for the Northern District of California seeking to compel EPA to promulgate State plans for visibility protection under section 110(c) of the Clean Air Act for those States which had not submitted such plans. During 1983, EPA and the plaintiffs negotiated and signed a settlement agreement which was accepted by the court on April 20, 1984. The settlement agreement calls for a two-part implementation of the 1980 rules. In compliance with the first part of the settlement agreement, new source review requirements and a visibility monitoring strategy were proposed for 34 deficient States in October 1984.[6] In a series of actions started on July 12, 1985 and finishing in 1986, EPA promulgated Federal implementation plans (FIP's) or approved State-submitted implementation plans to deal with visibility monitoring and new source review and thus fulfilled its responsibilities under the first part of the settlement agreement.

On September 9, 1986, the court approved a revision to the second part of the settlement agreement. Under that revised agreement, EPA was allowed to delay proposing portions of the implementation plans dealing with existing visibility impairment until August 1988. On November 24, 1987, EPA promulgated Federal plans for 29 States to satisfy the second part of the settlement agreement and thereby implement the remaining portions of the 1980 regulations.[7] (For related information on visibility protection, see Chapter IV, Section A.)

Tall Stacks and Other Dispersion Techniques

In July 1985, EPA adopted revisions to regulations originally promulgated in 1982 which prohibit reliance by stationary sources on stack heights in excess of "good engineering practice" or on any other dispersion techniques in lieu of emission controls.[8] In accordance with the Clean Air Act, States were given 9 months to review their rules and source emission limitations and to revise their SIP's and to resubmit them to EPA as necessary. During 1986, EPA received SIP revisions from the States in response to the stack height regulations. Most revisions pertaining to rule changes were processed by EPA by the end of 1987. SIP revisions pertaining to source emission limitations continued to be received and processed in 1987.

Several interested parties filed for judicial review of the revised stack height regulations and, in addition, several of those parties also filed petitions for reconsideration of those regulations. Some of the petitions which dealt with a specific source were denied in April 1986.[9] Since the other petitions dealt with the basic legal foundations for the regulations, EPA deferred responding to them until judicial review of the revised regulations was completed. The Court of Appeals for the D.C. Circuit responded to the petitions in January 1988. While upholding EPA's regulations in most respects, it remanded to EPA three issues relative to a grandfathering provisions, stack height credits allowed to certain pre-1979 sources, and certain sources with merged stacks.

B. PREVENTION OF SIGNIFICANT DETERIORATION AND NONATTAINMENT NEW SOURCE REVIEW ACTIVITIES

The EPA made significant progress in 1987 in carrying out its responsibilities under the Clean Air Act regarding the preconstruction review of new and modified stationary sources. Major 1987 activities are described below.

PSD Program Transfer

The EPA continues to emphasize the importance of high quality transfers of PSD and new source review programs. In addition to the strong legal and resource reasons for implementation by State and local authorities rather than EPA, the EPA believes that the critical growth decisions associated with the preconstruction review process should be made at the State and local level. The permitting process, once transferred, forms the key for minimizing source-specific SIP revisions in the future. In 1987, EPA continued its progress in transferring implementation of the PSD program to State and local agencies. The majority of PSD permits are now issued by these agencies. Although several transfers are presently being held up by litigation and resulting policy clarification, progress was made nevertheless. As of the end of 1987, 47 State and local agencies had either full delegation of the PSD program or a PSD SIP, and 6 more had partial responsibility for the PSD program.

Chemical Manufacturers Association v. EPA

As previously reported, the EPA's PSD and nonattainment new source review regulations have been challenged by a variety of entities. These challenges were consolidated as Chemical Manufacturers Association v. EPA (CMA), D.C. Cir. No. 79-1112. On February 22, 1982, EPA entered into a litigation settlement with the industry petitioners in which it agreed to propose certain regulatory changes. An important part of the settlement agreement was satisfied by EPA's Federal Register proposal of August 1983.[10] That proposal addressed the topics of fugitive emissions in new source review applicability determinations, Federal enforceability of various emissions reductions, "buffer zones" around Class I areas, review of secondary emissions, health and welfare equivalence when netting emissions, and offset credit for past source shutdowns. At the end of 1985, EPA had prepared final action on a significant portion of the settlement. These documents underwent internal EPA review during 1986. During that review, a number of controversial issues emerged which required EPA resolution. Publication of a final action on a portion of the CMA suit (Exhibit A) is planned for 1988 and final action on the second portion (Exhibit B) is planned for 1990.

An important related matter of controversy has been the definition of "source" for the purposes of nonattainment new source review. The Clean

Air Act is not clear in this area. In 1980, EPA promulgated a dual source definition that minimized the opportunity for modifications to sources to avoid review in nonattainment areas.[11] This was challenged by industry in the CMA suit, but was not of primary concern in the settlement because EPA had replaced it with a "plantwide" definition in its rulemaking of October 14, 1981.[12] The Natural Resources Defense Council (NRDC) claimed that the plantwide definition is inconsistent with the Clean Air Act and, on August 17, 1982, the D.C. Circuit Court of Appeals ruled in their favor. Both EPA and industry representatives appealed this ruling, and on June 25, 1984, the Supreme Court decided in favor of EPA and the industry litigants. In 1987, EPA developed a policy which will aid the Regions in processing proposed SIP's converting to a plantwide definition. This policy should significantly accelerate the processing of revisions to the nonattainment portions of SIP's.

In an August 7, 1980 promulgation, EPA listed 30 source categories for which fugitive emissions would be included in PSD applicability determinations.[11] Surface mining operations were not among these. The Sierra Club sued EPA on this point and on August 26, 1983, the D.C. Circuit Court of Appeals remanded this matter to the EPA for explanation of its position. In October 1984, EPA published final action on this issue, reaffirming its current requirements for the inclusion of fugitive emissions in calculating whether a source is "major" for purposes of new source review.[13] The EPA further proposed to extend the requirements for inclusion of fugitive emissions to surface coal mining operations.[14] According to the rulemaking criteria established by EPA, the proposed listing of surface coal mines is only a presumption which can be overcome if the rulemaking record reveals that the costs associated with listing are unreasonable relative to the corresponding benefits. A regulatory impact analysis was prepared on that proposal and was made available for public comment in early 1986. During 1987, EPA held a public hearing on the regulatory analysis and analyzed the issues which were raised by the impact analysis. In addition, EPA consulted with the Department of the Interior on various matters related to the regulation of strip mines. Final action on this issue is under development.

PSD Regulations for Nitrogen Oxides

In 1986, the Sierra Club and other environmental groups filed suit to force EPA to develop PSD regulations for nitrogen oxides (NO_x), as required by section 166 of the Clean Air Act amendment of 1977. Late in 1986, the court asked litigants to submit affidavits supporting their respective positions. The last of these was filed in early February 1987. In April 1987, the court ordered EPA to develop PSD regulations for NO_x on an expedited schedule. Specific deadlines were to propose regulations by February 9, 1988 and promulgate them by October 9, 1988. At the end of 1987, EPA was working toward completion of a Federal Register proposal notice in order to meet the court-ordered requirements. Since then, EPA has completed the rulemaking process.[15]

New Source Review Task Force

In 1986, EPA formed a special Task Force on New Source Review. The principal purpose in organizing this task force was to address growing concerns about the consistency and certainty of permits issued under the Clean Air Act's new source review (NSR) programs. The task force identified specific measures to ensure that delegated permitting agencies have the knowledge and skills necessary to correctly implement the NSR programs and to provide EPA with adequate information to assure that the technology and other program requirements are implemented consistent with Clean Air Act requirements. In 1987, based on the task force findings and recommendations, EPA commenced a long range plan to improve the timeliness, certainty, and effectiveness of the NSR permit process.

C. IMPLEMENTATION OVERVIEW AND ASSISTANCE

Proposed Ozone and Carbon Monoxide SIP Disapprovals

In 1987, EPA announced proposals to disapprove State clean air plans for 14 metropolitan areas that have not shown they can achieve EPA's ozone and/or carbon monoxide air quality standards by the end of 1987 or in the near term.[16] Along with the disapprovals, EPA proposed bans on construction in those 14 areas for major new sources and certain major changes to existing sources of those air pollutants.

The metropolitan areas affected are:

- Chicago, IL, for ozone;
- East St. Louis, IL, for ozone;
- Indiana portion of Chicago for ozone;
- Indiana portion of Louisville for ozone;
- Cleveland, OH, for carbon monoxide;
- Atlanta, GA, for ozone;
- Dallas-Ft. Worth, TX, for ozone;
- Denver, CO, for carbon monoxide;
- South Coast (including Los Angeles), CA for ozone and carbon monoxide;
- Fresno County, CA, for ozone and carbon monoxide;
- Sacramento County, CA, for ozone;
- Ventura County, CA, for ozone;
- Kern County, CA, for ozone; and
- Washoe County (Reno), NV, for carbon monoxide.

The construction bans were proposed to go into effect upon a final determination by EPA and would prevent the approval of permits for building major new sources or modifications of existing sources of volatile organic compounds (key elements in the formation of ozone) or carbon monoxide, depending on the pollutant for which the area is not attaining the standard. A major new source is defined as having the potential to emit 100 tons or more of the pollutant per year.

For the Cleveland area, in addition to the proposed construction ban, EPA proposed to restrict Federal highway funding and clean air grant funding because the State plan did not provide for implementing a vehicle inspection and maintenance program with tailpipe emissions tests in that area as required by the Clean Air Act.

State Implementation Plans for Lead

In July 1982, the Natural Resources Defense Council (NRDC) filed suit to require EPA to approve, or disapprove and promulgate, lead SIP's for States that did not submit adequate SIP's. The EPA negotiated a settlement with the NRDC giving States and EPA additional time for completing the SIP's. During the time provided for in the settlement agreement, the EPA and the States completed rulemaking for 29 of the 36 outstanding lead plans.

In 1987, EPA continued work on completing the remaining lead plans. During the year, the EPA approved three SIP's: Omaha, Nebraska; Northern Mariana Islands (new source review); and New Jersey (the three sources that were not approved in 1986). In addition, Jefferson County, Alabama, was approved with the stipulation that additional studies still need to be completed for a secondary lead smelter located there.

At the end of 1987, lead SIP's were still outstanding for Minnesota, Indiana, and for the area surrounding a lead smelter in El Paso, Texas. These actions (including the completion of the Jefferson County, Alabama studies) are scheduled for completion in 1988.

SIP Processing

During 1987, EPA formed a task group to investigate the basic approaches being used to review, comment on, and approve or disapprove revisions submitted both to existing SIP's and to new SIP's. These SIP revisions generally result from the need to meet new Federal requirements, changes in State legislation, and source-specific requests for changes to permissible operating parameters. The task group examined current SIP processing procedures, both formal and informal, evaluated the effectiveness of the current methods, and recommended certain modifications to the process and procedures in order to more effectively employ EPA's resources and reduce the amount of time required for final EPA action on these submittals.

Two major improvements in the SIP processing system were recommended. First, the elimination of excessive review within EPA and second, improvement in the certainty of the decision process. More specifically, the task group recommended accomplishment of the first objective by implementing a series of increasingly comprehensive reviews including early rejection of incomplete packages, delegation of approval authority to EPA Regional Administrators for selected actions, thereby eliminating headquarters review, and full headquarters review of nationally significant SIP's. Implementation of the second objective is to be achieved by more strict adherence to current formal procedures, an improved management system, evaluating SIP's on the basis of policies in effect when submitted, whenever possible, and improved guidance and communication.

Implementation of the recommendations of the task group will be undertaken in 1988. Where possible, the recommendations will be handled administratively with appropriate notice to State and local agencies. However, the public will be informed of the full range of improvements in the SIP review process through a notice to be published in the Federal Register in 1988.

Acid Deposition Implementation Issues

In 1984, EPA initiated an effort to explore with the States the potential issues that could arise in implementing possible acid deposition control programs that might be required. Accomplishment of this effort was planned in three phases--identifying key implementation issues and major options for dealing with them, evaluating various options using both "in-the-field" and "in-house" approaches, and preparing preliminary or prototype guidance on the issues. Major progress was made in 1984 on the first phase as EPA, in coordination with State and local air agencies, produced an initial listing and description of over 200 potential implementation issues.

In 1985 and 1986 the focus shifted to analyzing the issues and evaluating the options for dealing with them, particularly through "in-the-field" studies. These studies, called State Acid Rain (STAR) projects, were to be conducted by individual States although the results could have broad applicability to other States that might be involved in a possible acid rain control program. The projects were eligible for $3 million in funds that Congress had appropriated for this effort. In all, 46 projects were funded; thirty-seven States were involved in the effort directly and special procedures were established to allow other States to participate in the review and evaluation of the projects. A national STAR workshop was held in November 1985 for EPA and the States to discuss and review the progress of the STAR projects. In 1986, work on the STAR projects continued and EPA began reviewing results as the projects progressed. A second national STAR workshop, held in October 1986, provided States the opportunity to present their initial findings and discuss implementation requirements of hypothetical acid rain legislation.

By the end of 1987, work had been completed on 21 of the STAR projects and EPA began summarizing the results for a final report on the program. Knowledge gained from the program of the problems that would face the States and EPA in implementing a national acid rain program was used in preparing comments and testimony on proposed legislation, particularly in regard to implementation schedules and requirements. One important result of the STAR program was the realization that State public utility commissions, as well as environmental agencies, will of necessity play key roles in the implementation of any acid rain program. In 1987, EPA began an effort analogous to the STAR program to identify and study the implementation issues which will confront the State public utility commissions in an acid rain program. This effort is being conducted in cooperation with the National Association of Regulatory Utility Commissions and does not involve any additional Federal grant funds.

National Air Audit System

The National Air Audit System (NAAS) was developed in 1983 as a joint effort by EPA, the State and Territorial Air Pollution Program Administrators (STAPPA), and the Association of Local Air Pollution Control Officials (ALAPCO). The primary goals of the NAAS are to identify any obstacles that are preventing State and local air pollution control agencies from implementing effective air quality management programs and to provide EPA with quantitative information for use in defining more effective and meaningful national programs. The five air quality management areas of motor vehicle inspection maintenance, air quality planning and SIP activities, new source review, compliance assurance, and air monitoring are included in the NAAS. During 1987, specific State agency deficiencies identified during previous audits were being corrected through agreements between the EPA Regional Offices and the audited agencies.

VOC RACT Clearinghouse

For several years, EPA has published a Clearinghouse on matters relating to reasonably available control techniques (RACT) for volatile organic compounds (VOC's). The VOC RACT Clearinghouse is intended to be a long-term project to exchange technical information, to minimize duplication of effort and resources, and to provide guidance to regulatory agencies regarding VOC controls. The Clearinghouse is a joint effort with the STAPPA, ALAPCO, and EPA.

For 1987, EPA published three issues of the Clearinghouse covering the following topics:

- Common SIP Deficiencies
- Low-solvent Wood Furniture Coating
- Area Source Documentation for the National Acid Precipitation Assessment Program
- VOC Control Sessions at Air Pollution Control Association Conferences
- Documents Available
- VOC Leaks in the Synthetic Organic Chemical Manufacturing Industry and Refineries
- Control Cost Manual
- Proposed Auto Emissions Controls
- STAPPA/ALAPCO Ozone Strategy
- Definition of VOC's
- CTG VOC Source Cut-offs
- Proposed Disapproval of Ozone/CO Clean Air Plans
- Vessel Hydrocarbon Recovery Study
- Alternative Compliance for Graphic Arts RACT
- Post-1987 Ozone and Carbon Monoxide Policy - Summary of Concepts and Features

D. AIR POLLUTION TRAINING

In 1987, EPA continued to provide technical training in the abatement and control of air pollution. This training included short course presentations (3 to 5 days in length), self-study courses, technical assistance to others who conduct training, and the support of traineeships and fellowships for graduate air pollution training.

During 1987, EPA conducted 38 short courses in 19 different subject areas for a total of 1,050 students. These courses were presented in locations across the U.S. by six universities designated as area training centers. Technical assistance was provided to States and EPA Regional Offices for conducting 32 additional courses reaching a total of 888 students.

In support of the delegation of more air quality management responsibilities to the States, EPA continued emphasis on self-study courses as a means of providing training to more air pollution personnel. During 1987, 1644 students applied for the 30 self-study courses presently available.

As an additional means of developing qualified personnel, EPA supported 8 graduate traineeships/fellowships to employees of State and local air pollution control agencies. These awards are for both part-time and full-time graduate study in the field of air pollution control.

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VII. CONTROL OF STATIONARY SOURCE EMISSIONS

A. NEW SOURCE PERFORMANCE STANDARDS (NSPS)

Section 111 of the Clean Air Act requires EPA to regulate new stationary sources of air pollution from source categories which cause, or contribute significantly to, air pollution which may reasonably be anticipated to endanger public health or welfare. During 1987, NSPS were promulgated under this section for emissions of volatile organic compounds from rubber tire manufacturing[1] and volatile organic liquid storage tanks[2] and for sulfur dioxide emissions from industrial boilers.[3] The existing NSPS for lime manufacturing plants was revised[4] and the fossil fuel fired steam generator standard was amended to provide alternative compliance provisions for one power station.[5] Standards were proposed for polymeric coating, petroleum refinery wastewater, polymers manufacturing, and residential wood combustion.[6,7,8,9]

B. BACT/LAER CLEARINGHOUSE

New or modified facilities that are to be constructed in areas of the country that are currently attaining the national ambient air quality standards are required by the Clean Air Act to install best available control technology (BACT). In those areas of the country that have not yet achieved compliance with the air quality standards, new or modified facilities are required to meet the lowest achievable emission rate (LAER) for that particular type of source. Both BACT and LAER requirements are determined on a case-by-case basis. Often an air pollution control agency will need to establish BACT or LAER requirements for a source type that is completely new to them or for which they have had only minimal experience. In these cases, the permitting agency may not be knowledgeable of the more recent advances in control technology for such sources and it is extremely helpful if the agency can refer to BACT or LAER determinations made by other control agencies.

The EPA established the BACT/LAER Clearinghouse several years ago in order to assist State and local air pollution control agencies by promoting the sharing of air pollution control technology information. The primary output of the Clearinghouse is an annual report of information about BACT/LAER determinations made by the various control agencies. The report published in 1987 contains over 1300 BACT/LAER determinations.[10] The report is available in hard copy or through an automated system. The automated data base can be accessed by both the public and private sectors.

C. REFERENCES

1. 52 FR 34868, September 15, 1987.

2. 52 FR 11420, April 8, 1987.

3. 52 FR 47826, December 16, 1987.

4. 52 FR 4773, February 19, 1987.

5. 52 FR 28946, August 4, 1987.

6. 52 FR 15906, April 30, 1987.

7. 51 FR 6334, May 4, 1987.

8. 52 FR 36678, September 30, 1987.

9. 52 FR 4994, February, 18, 1987.

10. "BACT/LAER Clearinghouse - A Compilation of Control Technology Determinations, Second Supplement to 1985 Edition," June 1987.

VIII. STATIONARY SOURCE COMPLIANCE

A. GENERAL

The goal of the Clean Air Act is to protect public health and welfare and to enhance the quality of the nation's air. The stationary source compliance program is designed to assure compliance with air emission standards by stationary sources of air pollution, including such major facilities as power plants, steel mills, smelters, and refineries. In addition to ensuring compliance with emission limitations contained in State implementation plans (SIP's), EPA and delegated States are responsible for ensuring that sources comply with new source performance standards (NSPS) and national emission standards for hazardous air pollutants (NESHAP).

The EPA closely monitors the compliance status of 36,342 stationary sources of air pollution. Approximately 31,500 of these sources are Class A SIP sources*, about 3,500 are NSPS sources, and about 1,000 are non-asbestos NESHAP sources. At the end of 1987, as has been the case since the late 1970's, the compliance rates were high as shown in the table below:

Compliance Status of Federally Tracked Stationary Sources

Source Type	In Compliance	In Violation, Meeting Schedule	In Violation, No Schedule	Status Unknown
Class A SIP	91.3%	1.9%	4.1%	2.6%
NSPS	89.9%	2.0%	4.9%	3.3%
NESHAP	86.9%	1.8%	4.7%	6.5%

The compliance status of stationary sources is determined and tracked principally by the States. The States (and EPA) have the authority to enter and inspect stationary sources in order to obtain information for determining compliance status or for preparing possible enforcement actions or for other purposes. In 1987, the States conducted 33,481 inspections and source tests of Class A SIP, NSPS and non-asbestos NESHAP sources.

The EPA overviews the compliance monitoring activities of the States and supplements their enforcement efforts to resolve violations of air quality regulations. In 1987, EPA conducted 2,377 inspections and source tests of Class A SIP, NSPS and non-asbestos NESHAP sources.

The demolition and renovation of old buildings, often in densely populated urban areas, can be a major source of asbestos exposure. Such sources are regulated under the NESHAP for asbestos. Because of the large number of demolition sites, and the transient nature of the potential asbestos releasing activity, these sources are tracked and reported separately from other stationary sources of air pollution. During 1987, EPA and States received 43,496 asbestos demolition or renovation notifications (an increase of 61% over 1986), conducted 17,616 asbestos inspections, and found 2,191 violations.

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* A Class A SIP source is a stationary source which, while operating at design capacity, has actual or potential uncontrolled emissions equal to or greater than 100 tons per year of any regulated air pollutant.

The Clean Air Act provides a variety of administrative enforcement mechanisms for dealing with both special situations and relatively easily corrected violations. During 1987, EPA issued immediate compliance orders under section 113(a) of the Act to 185 sources (108 of which were asbestos sources) and issued or approved delayed compliance orders under section 113(d) for 3 sources.

Section 120 of the Act is an administrative remedy designed to recoup economic benefit which may come from violating air pollution control regulations. Ten section 120 cases were initiated in 1987.

The EPA is also authorized to file civil and criminal actions in Federal District Court to compel a source to comply with applicable requirements, to pay penalties, or both. A total of 73 Federal civil actions were filed in 1987 against stationary sources for violations of the Clean Air Act. Most were caused by violation of standards regulating emissions of asbestos, or particulates, or volatile organic compounds. As of January 1988, a total of 125 such actions were pending with the U.S. District Courts. During fiscal year (FY) 1987 (the period starting October 1, 1986 and ending September 30, 1987), two criminal cases were filed for violation of asbestos regulations and subsequent violation of an EPA administrative order. On December 30, 1986, the defendants pled guilty to violating NESHAP standards, and each was sentenced to a $1,000 fine.

A major focus of the stationary source compliance program is the effort to return to compliance those sources considered to be "significant violators." The universe of sources covered by this program includes those that are in violation of NESHAP or NSPS regulations, and non-compliant Class A SIP sources which contribute significantly to nonattainment of the national ambient air quality standards. For FY 1987, EPA identified 637 significant violators pending at the beginning of the fiscal year. By the end of the fiscal year, 490 had been addressed. Of these, 247 were returned to compliance, 108 were placed on an acceptable compliance schedule, and 135 had an enforcement action pending. In addition, 583 significant violators were newly-identified during FY 1987 and of these, 187 were addressed by the end of the fiscal year.

In 1984, EPA issued guidance on the "timely and appropriate" EPA/State enforcement response for significant air-violators. On April 11, 1986, this guidance was reissued to include NESHAP violators. The guidance provides timeliness for action, addresses EPA issuance of notices of violation (particularly when the primary agency does not take action), and discusses when penalties must be obtained. In 1987, for the third consecutive year, EPA evaluated the implementation of the "timely and appropriate" guidance. The evaluation showed that, while certain requirements of the guidance were not always met, implementation has been successful in that it has caused expeditious resolution of violations. It eliminates disagreements over who has responsibility for a violation and provides notice to States and sources on when EPA may step in and initiate an enforcement action. Major highlights of the evaluation are:

- 71% of violations remaining at the beginning of the fiscal year or noted in the first three quarters were resolved by November 1, 1987.
- Enforcement actions were instituted for approximately half the violations resolved, and almost all of the resolutions included penalties. When EPA took primary responsibility for a violation, the likelihood of resolution through enforcement action was higher, as was the likelihood of assessment of penalties.

For the last 4 years, EPA's air pollution compliance program has focused considerable attention on control of emissions of volatile organic compounds. These sources are major contributors to the ozone nonattainment problem, and some emit compounds which are highly toxic. In response to requirements contained in the 1977 Clean Air Act Amendments, many States adopted regulations requiring compliance of such sources on or before the end of 1982. These regulations have increased the number of major regulated sources and implementation has led to a steady increase in the number of significant violators.

Small sources of volatile organic compounds have recently come under increasing scrutiny. Emitters such as gas stations, paint spraying operations, printing presses, architectural coatings and certain personal consumer products individually contribute small amounts of volatile organic compounds; however, their aggregate contribution impacts ozone attainment. The EPA has therefore concluded that in most major urban areas, small sources of volatile organic compounds must be controlled if the ozone standard is to be reached. Consequently, EPA has initiated a small source compliance program to encourage these sources to comply with existing regulations. The special problems that small businesses experience have been taken into consideration and each jurisdiction has been given enough flexibility to allow for innovative and cost efficient approaches to control.

In the decade of the 1970's, the stationary source compliance program focused on ensuring that major sources of particulates and sulfur dioxide achieved initial compliance with Act regulations, generally by installing control equipment or switching to cleaner fuels. The more recent focus of attention is concerned with the continuous compliance of particulate and sulfur dioxide sources (while continuing work to ensure initial compliance for sources of volatile organic compounds).

Encouraging the installation and use of continuous emission monitors is one component of the continuous compliance effort. On July 28, 1987, guidance was issued calling for increased use of continuous emission monitors and integration of information reported by continuous emission monitors into surveillance/compliance activities. Another component of the continuous compliance effort is the targeting of inspections to help maximize the effective use of limited inspection resources. In the past, EPA guidelines have focused on source size as the determinant whether a source should be inspected. The EPA has conducted several pilot programs for the purpose of including other factors such as compliance history and air quality as determinants. Pilot programs in Michigan and Colorado were used to develop a procedure (called a targeting model) for using such information to target inspections; success of the targeting model to date indicates that a more widespread application is justified.

On February 18, 1987, EPA proposed a new source performance standard for residential wood heaters under section 111 of the Clean Air Act[1]. This standard allows for certification of woodstove model lines. In 1987, this certification program was put into place. Nine laboratories have been accredited, numerous tests have been performed, one wood heater has been approved by EPA directly for certification, and ten additional model lines have been approved under the "grandfather" certification program.

Significant progress has also been made in the area of training. During 1987, EPA prepared a multilevel curriculum for EPA personnel engaged in stationary source compliance inspections. The objectives are to ensure that every inspector can conduct advanced levels of inspection and that experienced personnel can stay current and can develop specialized skills. Emphasis is on quality inspections, health and safety, and transferability to State/local programs. A total of 35 workshops were conducted in 1987. Courses and work materials will be streamlined, consolidated, and updated over the next three to four years. An air training advisory board composed of Federal, State, and local personnel will oversee the program.

B. LITIGATION

The following are examples of significant enforcement actions which were taken in 1987:

1. Significant Judicial Decisions

United States v. Ford Motor Co., 814 F.2d 1099 (6th Cir. 1987)

The Sixth Circuit held that the U.S. can enforce the current federally-approved State implementation plan (SIP) even though the defendant and the State of Michigan had entered a consent judgment in State court invalidating the SIP regulation. The court held that the State could revise its SIP only by submitting a revision to EPA for approval. The court distinguished this case from previous cases which recognized a State court invalidation of SIP regulations based on procedural deficiencies in adoption of the regulations. The Sixth Circuit also ruled that Federal enforcement of the current SIP regulation could proceed despite the pendency of a SIP revision proposed by the State.

United States v. Wheeling-Pittsburgh Steel Corp., 818 F.2d 1077 (3rd. Cir. 1987)

The Third Circuit also ruled that Federal enforcement of an existing SIP could proceed despite the pendency of a SIP revision. In this case, the District Court had ordered a modification to a consent decree based in part on a "bubble" proposal which the State had not formally submitted to EPA. The Circuit Court ruled that the district court erred and held that the company was not relieved of its obligations to comply with existing SIP requirements.

American Cyanamid Co. v. EPA, 810 F.2d 493 (5th Cir. 1987)

The Fifth Circuit held that the agency could not pursue a section 120 penalty action until it rejected a State-proposed SIP revision which would have put the company in compliance. The court found that EPA must accept or reject a proposed SIP revision within the same four month interval specified by Congress for EPA to take action on original SIPs. Moreover, the court ruled that EPA may not commence an action to collect administrative noncompliance penalties under section 120 of the Clean Air Act where the State had submitted a proposed SIP revision that would put the company in compliance and where EPA failed to reject the revision in four months. The court also held that EPA may not collect section 120 penalties from the date of submittal of such a proposed revision to the date EPA rejects it.

2. Significant Administrative Decisions

International Harvester Co., Appeal No. 87-1

The EPA Chief Judicial Officer ruled that technical and economic infeasibility may not be raised as a defense to assessment of administrative noncompliance penalties. The decision on appeal affirmed an Administrative Law Judge's finding of violation.

Youngstown Thermal Corp., No. CAA-V-85-A-24

In a preliminary ruling, an Administrative Law Judge held that where a company is not complying with either the existing regulation or a proposed SIP revision, EPA may proceed to assess penalties even when the proposal has been pending more than four months.

3. Significant Settlements

United States v. Magma Copper Co., Civ. No. 87-106 TUC WDB (D. Ariz.)

A consent decree was entered on September 28, 1987 resolving a civil action against Magma Copper. The consent decree requires the company to comply with applicable particulate and sulfur dioxide emission limitations by November 1, 1988. Magma must pay a civil penalty of $600,000.

United States v. Occidental Chemical Corp., Civ. No. 85-4558 (AET) (D. N.J.)

A consent decree was entered on July 2, 1987 resolving a civil action against Occidental Chemical Corporation for violations of the national emission standard for vinyl chloride, a hazardous air pollutant. The decree requires the company to implement a detailed compliance plan to prevent emissions of vinyl chloride to the atmosphere from a polyvinyl chloride plant. The decree also requires Occidental to pay a civil penalty of $490,000.

4. Enforcement Initiative

Automobile Coating Cases

The United States filed four civil actions in 1987 against automobile coating facilities owned by General Motors Corporation. The cases allege violations of SIP requirements to control emissions of volatile organic compounds, which contribute to the formation of ozone. All of the facilities are located in primary nonattainment areas for ozone.

C. COMPLIANCE AND ENFORCEMENT GUIDANCE

In 1987, EPA issued the following guidance memorandums:

"Review of State Implementation Plans and Revisions for Enforceability and Legal Sufficiency (September 23, 1987)." This document describes elements which must be included in a SIP or a SIP revision in order to make it enforceable. A checklist is included.

"Setting Enforcement Actions in Clean Air Act Nonattainment Areas Against Stationary Air Sources which will not be In Compliance by the Applicable Attainment Date (November 23, 1987)." This document discusses the criteria for allowing a source to remain in operation and out of compliance beyond the attainment date. These criteria must be elements of a Federal consent decree.

D. COMPLIANCE BY FEDERAL FACILITIES

A total of 369 Class A SIP, NSPS and NESHAP Federal facilities are tracked in the air program. As of September 1987, 302 (81%) were in compliance, 11 were meeting schedules that will bring them into compliance, 26 were in violation and not yet on an acceptable schedule, and 7 were of unknown compliance status.

E. LIST OF VIOLATING FACILITIES

Section 306 of the Clean Air Act provides the authority for EPA to place facilities on the List of Violating Facilities, thereby prohibiting any Federal agency from procuring goods or services produced at that facility. Section 306 is implemented through Executive Order 11738 and EPA regulations codified at 40 CFR Part 15. In 1985 EPA promulgated revised regulations for implementing section 306. Under the revised regulations, facilities where criminal violations of the Clean Air Act occurred are automatically placed on the List of Violating Facilities, effective the date of the conviction. Other facilities which have continuing and recurring violations may be placed on the List at the discretion of the EPA, after notice to the owner or operator and the opportunity for an administrative hearing.

During 1987, a Contractor Listing Task Force met regularly to address issues related to contractor listing. In October 1987, EPA issued contractor listing protocols, a guidance document which sets forth the procedures that EPA will follow in carrying out the contractor listing regulations, and the assistance that is required from other EPA offices supporting the contractor listing program. This guidance is intended to enable the enforcement offices in EPA's Regional Offices to make greater use of contractor listing as a supplemental enforcement tool.

With the development of the protocols, EPA is placing more emphasis on enforcement actions under the contractor listing authority. During 1987, EPA listed two facilities under the Clean Air Act as a result of criminal convictions for violations of the asbestos removal standards, removed three facilities from the list, handled one appeal, and reviewed three recommendations to list. At the end of 1987, there were three facilities on the list for Clean Air Act violations, one decision to list pending appeal, and two listing proceedings pending.

F. REFERENCES

1. 52 FR 4994, February 18, 1987.

IX. CONTROL OF MOBILE SOURCE EMISSIONS

A. INTRODUCTION

Control of motor vehicle emissions has been a Federal responsibility since 1968. The requirements of the Clean Air Act (Act) relating to mobile sources have been subsequently refined several times, most recently in 1977. The Clean Air Act Amendments of 1977 established an ambitious regulatory program which addressed remaining problems in the motor vehicle emissions control program and bolstered efforts to attain and maintain the national ambient air quality standards for carbon monoxide and ozone. Below are listed some of the mobile source provisions of the 1977 Act.

- A schedule was established for implementation of stringent emissions standards for automobiles -- 0.41 grams per mile (gpm) for hydrocarbons (HC), 3.4 gpm for carbon monoxide (CO), and 1.0 gpm for oxides of nitrogen (NO_x). The table below displays the level of control mandated by the standards.

New Light-Duty Vehicle Emissions

	Without Control	1977 CAA Standard	Percent Reduction
Hydrocarbons	8.8 gpm	.41 gpm	95%
Carbon Monoxide	87.0 gpm	3.4 gpm	96%
Oxides of Nitrogen	3.6 gpm	1.0 gpm	72%

- Similarly, the amendments tightened standards for emissions of the above mentioned pollutants from heavy-duty engines.
- Standards for the control of particulate emissions from heavy-duty diesel engines were mandated.
- Areas not meeting carbon monoxide and ozone ambient air quality standards by 1982 were required to implement motor vehicle inspection and maintenance (I/M) programs.

Since the enactment of the 1977 amendments, EPA has made steady progress toward achieving the Act's goals. The EPA has made a number of modifications to its motor vehicle emissions standards in order to assure that they attain the goal of cleaner air as effectively and efficiently as possible. In 1987, EPA made significant progress toward the implementation of this program.

B. OZONE CONTROL

With the increased focus on reducing ozone levels, EPA has continued work on several areas directly aimed at this goal. One of the key actions is controlling excess evaporative emissions through regulation of in-use gasoline volatility. The EPA proposed a rule in 1987 on gasoline volatility.[1]

Hearings were held in October and a final rule is expected in 1989. A second action aimed at ozone reduction is control of refueling emissions. The EPA proposed a rule establishing refueling emission standards for automobiles along with the gasoline volatility proposal.[2] A third ozone related action was the continued development of a notice of proposed rulemaking which would tighten the light-duty truck exhaust hydrocarbon standard. Publication of the proposal is expected in 1988. Other work related to ozone (and carbon monoxide) control involved providing guidance to States on how to assess the effects of alternative fuels on their air quality. A guidance document was developed with release expected in 1988. In particular, exhaust emission credits are provided for the use of gasoline-oxygenate blends of ethanol, methanol, and methyl tertiary butyl ether (MTBE) as well as fuel methanol and compressed natural gas. This guidance document was also an important piece of EPA's carbon monoxide attainment strategy. In addition, EPA worked closely with Colorado and Arizona in 1987 in their development of alternative fuel programs.

C. VEHICLE FUELS AND AIR TOXICS

Several initiatives were related to vehicle fuels in 1987. In the first, EPA began to develop a comprehensive study of the potential costs and benefits of reducing the sulfur and aromatics content of diesel fuel, an action that may lead to significant reductions in particulate emissions from diesel engines. Stringent technology-forcing standards were established in 1985 for 1991 and 1994 and later heavy-duty diesel engines. Reducing the fuel content of sulfur and/or aromatics may improve the ability of manufacturers to meet these standards, as well as provide other economic and environmental benefits. In 1987, EPA decided to directly pursue a notice of proposed rulemaking, incorporating the study as a part of the regulatory impact analysis supporting the rulemaking. Publication of the proposal is expected early in 1989. A second initiative was a proposal to establish testing protocols to determine the health effects of fuels and fuel additives. An inventory of current commercially-available fuel additive materials was developed. An advance notice of proposed rulemaking on this topic will be published in 1989. In another initiative, a motor vehicle assessment for an Agency-wide task force on formaldehyde exposure and control strategies was completed. Finally, EPA also initiated a program effort to evaluate the importance of photochemical transformation chemistry to the mutagenicity of motor vehicle emissions. Actual vehicle emissions were irradiated in a laboratory chamber with changes in mutagenicity evaluated using bioassays. Results of this program are scheduled for publication in 1990.

The EPA also has responsibility for enforcing section 211 of the Clean Air Act relating to the regulation of fuels and fuel additives. One of the regulations under this section of the Act is aimed at protecting the catalytic converters on 1975 and later model year cars. The EPA has established a nationwide fuels enforcement program to ensure that affected retail outlets comply with these regulations. This program includes sampling of the fuel at retail outlets by EPA field inspectors and private or State inspectors under EPA contracts or grants, in order to measure the fuel's lead content. The EPA conducted approximately 18,000 inspections under this program during 1987.

The lead phasedown program continues to achieve significant reductions in the use of lead in gasoline, from ten billion grams in 1986 to six billion in 1987. This represents a 97 percent decrease from the 206 billion grams of lead which were used in gasoline in 1973. The ability to use banked lead usage rights ended in 1987. This, combined with an anticipated decrease in demand for leaded gasoline, will result in further reduction in lead usage. The standard remains at 0.10 grams per leaded gallon (0.10 gplg) as a quarterly average for a refinery or importer. In 1987, EPA and the U.S. Department of Agriculture (USDA) issued a study on the use of low-leaded (0.10 gplg) and unleaded gasoline in agricultural equipment designed for leaded gasoline, as required by the 1985 Farm Bill. The study found 0.10 gplg to be adequate, but that some engines designed for use with leaded fuel would have some premature exhaust valve wear if operated exclusively on unleaded gasoline. Three public hearings were held to receive comments on the study. A report to the President and the Congress was drafted for issuance in early 1988.

The EPA mobile source air pollution control program has shifted enforcement efforts from fuel switching to the fuel refiner/importer audit program to assure compliance with the lead phasedown regulations. Investigation and enforcement in this area involves extensive analysis of the production, importation and blending of gasoline, gasoline blendstocks and lead additives. The EPA also tracks the banking and withdrawal of lead rights and related documents and records and has successfully conducted a number of these audit-type investigations. Computer programs help analyze the refiners' records and a strategy has been developed to integrate and evaluate all sources of data available to identify potential refiners and importers for investigation. The EPA conducted investigations of more than 20 refiner facilities during 1987 and 18 Notices of Violation (NOV's) were issued with proposed penalties of over $24 million. Three large lead phasedown settlements in 1987 resulted in penalties of approximately $4.2 million. Future cases of this type are also likely to involve significant violations with proposed penalties and settlement amounts in the multi-million dollar range.

As part of the reduction of lead in gasoline, the EPA Administrator signed a final rule eliminating lead in test fuel.[3] This will mean that manufacturers of engines not requiring catalysts, such as certain heavy-duty, gas-powered engines, must meet emission standards using unleaded gasoline.

The Fuel and Fuel Additive Registration System has been overhauled in 1987 to improve its effectiveness in quickly identifying environmental problems associated with chemical substances used in motor fuels. This registration function will assure that EPA is knowledgeable about the chemical content of fuels and fuel additives. In conjunction with EPA's development of test protocols for assessing health effects, the system will enable EPA to assure that proper restrictions are placed on substances which cause harm to the environment and/or public health. Further, the registration system permits EPA to monitor the compliance of fuel and fuel additive manufacturers with the requirements of Section 211 of the Clean Air Act concerning waivers for new fuels or additives.

Increasingly, attention is being focused on toxic air pollution in urban areas. Mobile sources contribute as much as sixty percent of the urban air toxics emissions. In 1987, EPA released a technical report providing a compilation of available information on air toxics emissions from motor vehicles, the status of regulations affecting these emissions, and a range of risk estimates for their effect on public health both now and for future years.

D. STANDARD SETTING

As part of an ongoing effort in controlling ozone, EPA in 1987 continued its efforts in the development of alternative fuels technologies. These efforts have additional benefits in helping to reduce emissions of carbon monoxide and other pollutants, as well as reducing our dependence on foreign oil. In addition, as mentioned before, there has been significant activity in the effort to reduce particulate matter from diesel engines. Accomplishments in this area in 1987 include the following:

- As mentioned before, EPA proposed refueling emission standards for motor vehicles, and also proposed volatility standards for vehicle fuels in order to reduce hydrocarbon emissions.

- In anticipation of the development of methanol as an alternative fuel, EPA moved forward in the development of emission standards for methanol-fueled vehicles. Methanol has the potential to reduce hydrocarbon emissions from gasoline engines and particulate emissions from diesel engines. A final rulemaking is planned for 1988.

- The EPA held a workshop on and began developing a proposed rulemaking to permit the banking and trading of oxides of nitrogen and particulate matter emission credits among heavy-duty gasoline, diesel, and methanol engine manufacturers. A proposal is expected in 1988.

- The EPA continued to promulgate nonconformance penalties for those heavy-duty engine families unable to meet certain standards applicable to a given model year. This mechanism assures that no manufacturer benefits financially from nonconformance with the emission standard, and that the least effective technology does not determine the stringency of standards for the entire industry. A proposal to increase the stringency of the 1991 light-duty diesel truck particulate standard for light-duty trucks with heavy-duty engines and to propose nonconformance penalties was published in 1987.[4] The final rule is planned for 1988. Rulemaking proposals to make nonconformance penalties available for 1991 and 1994 heavy-duty vehicle and heavy-duty engines and to allow EPA to waive the payment of nonconformance penalties for engines sold in California on which nonconformance penalties have been paid to the State of California are planned for 1988.

- The EPA incorporated newly received emissions data into a study of railroad emissions which it has been conducting. The complete study is scheduled for release in 1988. In addition, completion of a more general contractor report on emissions from all off-road diesel vehicles is expected early in 1988.

E. PREPRODUCTION COMPLIANCE

One of EPA's key techniques for assuring the compliance of vehicles with the motor vehicle emissions standards is the preproduction certification program. Initiated in 1968, the program involves the engineering review and testing by EPA staff of engine families representing new vehicles which are to be sold in the United States. This process includes the submission of technical data from manufacturers about prospective production vehicles, emissions testing of prototypes by manufacturers, a review of engineering data and test results by EPA personnel, and, in certain cases, confirmatory testing of prototypes at EPA's National Motor Vehicle Emissions Laboratory in Ann Arbor, Michigan. This procedure identifies and resolves potential problems which could result in excessive in-use emissions. Correcting these problems at the preproduction stage assures maximum environmental benefits and reduces compliance cost to the industry compared to correcting the problems when discovered in use.

The EPA's National Motor Vehicle Emission Laboratory performed over 2500 emission tests on 750 preproduction prototype vehicles and 500 in-use vehicles in 1987. Correlation activities with the regulated industry increased with the commencement of a technical exchange program with the Motor Vehicle Manufacturers' Association (MVMA). This effort should result in better correlation with industry and thus less time spent by industry contesting EPA data.

The EPA's vehicle certification program is the only vehicle emission compliance program which evaluates all vehicle designs from each manufacturer. It is also the only program which screens vehicles for elements of design known as defeat devices. A defeat device allows a vehicle to pass emission standards when tested according to Federal test procedures but produce unacceptably higher emissions when operated under other conditions. Coupled with the Selective Enforcement Audit and in-use compliance test programs, the certification program establishes the necessary oversight to assure vehicles are adequately designed and constructed for satisfactory in-use emissions performance.

As a result of a series of regulatory reforms implemented over the last several years, the certification process has become a more flexible and efficient program. Reduced testing requirements, administrative streamlining, and effective use of computerization has eased the procedural burdens to the manufacturers and increased the speed and efficiency of EPA's review and approval process. The process has evolved from one of EPA directing and approving every step to one that is largely self-implemented by the manufacturers subject to EPA's audit. This has resulted in a highly leveraged program which allows EPA to focus its resources on oversight of potential problem areas while giving the manufacturer maximum control over the timing of the more routine events.

In 1987, EPA published a notice of proposed rulemaking which would greatly expand the voluntary aftermarket parts certification program.[5] Expected to be promulgated in late 1988, this change in regulations will allow manufacturers to certify for emission compliance a wide range of aftermarket parts. Consumers will be able to purchase these aftermarket parts for vehicle maintenance with confidence that the parts will allow their vehicles to maintain good emission performance. Use of these certified parts will also protect the vehicle owner's emission performance warranty.

The current emphasis is on assuring maximum in-use benefit from the preproduction certification program. This emphasis includes three parts: (1) careful monitoring to confirm full compliance with existing regulations, (2) in-use vehicle testing to quantify the level of emissions performance slippage between the preproduction prototype vehicle certification test results and actual in-use vehicle emission performance, and (3) identification of potential certification program changes to improve its cost-effectiveness.

F. VEHICLE INSPECTION PROGRAM

An effective strategy for dealing with in-use emissions problems is the establishment of motor vehicle inspection and maintenance (I/M) programs. The EPA's basic approach in this area was determined by the 1977 amendments to the Clean Air Act. Urban areas of the country which obtained an extension in the deadline for attaining the ambient air quality standards for ozone and carbon monoxide beyond 1982 are required by the Clean Air Act to implement an I/M program. The EPA has also interpreted the Act to require areas which did not achieve attainment in 1982 as predicted to implement I/M programs unless they could otherwise prospectively demonstrate attainment by 1987. In 1987, EPA continued to promote the implementation of I/M programs in each locality where they were needed. By the end of the year, 60 of 64 areas had initiated programs.

To assure that operating I/M and antitampering programs actually achieve the planned emission reductions, EPA has initiated a systematic I/M auditing plan. In previous years, EPA conducted 31 initial audits and 8 follow-up audits. In 1987, EPA audited an additional 9 I/M programs and conducted 6 follow-up audits. Auditing and thorough follow-up by Federal, State and local officials will pinpoint and lead to correction of any major deficiencies in individual programs. In 1987, EPA notified governors or other high officials in 6 states that major problems had been found, and requested corrective plans.

In addition to I/M programs, EPA has promoted the implementation of State and local antitampering and anti-fuel switching enforcement programs. By the end of 1987, 36 programs had been implemented. Tampering and fuel switching programs focus on correcting and deterring the removal and rendering inoperative emission control devices. Therefore, they complement the tailpipe I/M programs. In seven I/M programs no emission check is performed, but antitampering and fuel switching checks make up the entire inspections. By the end of 1987, a total of 25 antitampering and anti-fuel switching programs had been added to existing tailpipe I/M programs.

G. MOBILE SOURCE ENFORCEMENT

The EPA mobile source enforcement program is directed primarily toward achieving compliance with motor vehicle emissions standards and fuel regulations as required by the Clean Air Act. The major goals and objectives are to: (1) assure that both new and in-use vehicles meet emissions standards, (2) assure that emissions control systems are not removed or rendered inoperative, (3) assure that harmful additives are not present in gasoline, (4) assure the reductions of lead in gasoline are achieved, (5) administer statutory and California emissions standards waivers, and (6) administer the statutory emissions warranties. To accomplish these goals, EPA maintains a number of basic motor vehicle enforcement programs:

Selective Enforcement Auditing

In order to assure that production vehicles and heavy-duty engines are built in accordance with emissions standards, EPA conducts Selective Enforcement Audit (SEA) test programs at manufacturers' facilities. The SEA program is a highly leveraged one. For every car EPA requires manufacturers to test during an audit, over a hundred cars are voluntarily tested by auto producers to assure that the audits do not result in a failure which could affect vehicle production. Since this close scrutiny by manufacturers results in the repair of vehicle classes that are only marginally meeting requirements, EPA has been able to reduce the number of audits it requires. In 1987, EPA conducted 22 SEA's, including four at foreign manufacturer's facilities, with a new effort in testing heavy-duty engines for compliance. Additionally, five production compliance audits for nonconformance penalties were conducted, and approximately $7.4 million in penalties were collected.

Recall Program

Section 207(c) of the Clean Air Act authorizes EPA to order the recall of vehicles if a substantial number of any class of vehicles do not conform to emissions standards during their useful lives. During 1987, a total of 1,537,000 vehicles were recalled as a result of EPA investigations. In the same period, manufacturers voluntarily recalled an additional 1,408,706 vehicles to correct emissions problems. The EPA conducted a total of 33 recall investigations in 1987, and performed 658 tests of in-use vehicles at laboratory facilities in Springfield, Virginia and Ann Arbor, Michigan.

In 1987, the City of New York started a methanol bus demonstration program, using methanol-fueled buses provided by General Motors Corporation under a settlement agreement reached with EPA as a remedy for the recall of certain models of 1979 and 1980 General Motors automobiles for excessive NO_x emissions. General Motors agreed to provide New York with a total of 32 buses.

Historically, the motor vehicle recall program focused its efforts on light-duty automobiles as they comprise the majority of the vehicles on the road. In 1987, however, the program expanded its surveillance of light-duty trucks and heavy-duty engines in recognition of the increasingly stringent emission standards and useful life requirements applicable to these vehicles. This coverage included emission testing of light-duty trucks and field surveys of heavy-duty engines emission control systems.

Fuels Enforcement Program

As mentioned before, EPA has greatly increased its lead phasedown enforcement activities in 1987. In 1987, EPA issued 18 notices of violation with $24 million in proposed penalties. In addition, EPA worked with the Justice Department in civil and criminal prosecution of refiners based on notices of violation issued in previous years. These rules are creating a demand for other additives which may have a harmful impact on auto emissions. The EPA expects that the proliferation of additives will create a need to monitor the composition of vehicle fuels even more closely than in the past.

In a related area, EPA relaxed restrictions on a fuel additive waiver for a methanol blend in 1987. This is expected to become an increasingly important area in response to the ongoing lead phasedown program, as refiners experiment with various additives as substitutes for lead in vehicle fuel.

Analysis of gasoline for various additives, primarily lead and alcohol, was an area of substantial effort by the Motor Vehicle Emission Laboratory in 1987. Over 10,000 samples from EPA's National Tampering Survey were analyzed for lead. For specific enforcement cases, 500 samples were analyzed for lead and 1000 for alcohol. In addition, a major effort in the area of fuel volatility was begun as part of the previously-mentioned regulation proposed in 1987.

Tampering/Fuel Switching

The EPA is also responsible for carrying out programs designed to deter tampering with vehicle emissions control systems or using leaded fuel in vehicles which require unleaded fuel. Surveys undertaken by EPA have shown tampering and fuel switching to be continuing serious problems which undermine the emissions control performance of many in-use vehicles. The 1987 Motor Vehicle Tampering Survey indicates that about 19 percent of the vehicle fleet is subject to gross tampering, and about 7 percent to fuel-switching. Tampering and fuel-switching enforcement activities continued in 1987 with the issuance of 297 notices of violation with proposed penalties of $2.6 million. Of these, 65 were tampering violations with proposed penalties of $1.6 million. Similarly, EPA settled a total of 406 fuels and tampering cases during the year for $3.3 million. Also, as mentioned above, EPA has promoted the implementation of State and local antitampering enforcement programs. By the end of 1987, 36 programs had been implemented.

Development of Aftermarket Catalytic Converter Policy

A critical element of State and local tampering inspections is the availability of replacement emission control components. The EPA published a policy regarding aftermarket catalytic converters that established test procedures, performance standards and installation requirements for aftermarket converters. Under this policy, replacement converters would be used only in specified circumstances. Any other replacements would have to be equivalent to those installed by the vehicle manufacturer. The policy also contains reporting and record-keeping requirements to aid EPA in monitoring appropriate use of aftermarket converters. A number of investigations were initiated during the year to determine compliance with the policy. The policy became effective in late 1986, but has been clarified for 1988, at which time EPA will intensify monitoring compliance and bring enforcement actions when warranted. The EPA has already brought enforcement actions proposing penalties of $120,000 against two automobile dealerships for aftermarket converter violations. The EPA also investigated one manufacturer of aftermarket catalysts and determined that the devices did not perform the essential function of a catalytic converter. A Federal District Court granted EPA's request for an injunction preventing further marketing of the device, and ordered the company to notify each purchaser that the installation of the device could result in tampering liability. The EPA's action in this case heightened awareness in the industry and strongly conveyed EPA's intent to enforce these requirements.

Emission Warranty Enforcement

The EPA is also responsible for assessing whether the Federal emission warranty requirements of sections 207(a) and (b) of the Act are implemented. During 1987, EPA responded to a total of 1,253 inquiries. Of these, 153 were complaints specifically related to warranty coverage and were referred to the appropriate vehicle manufacturer for resolution. A pamphlet outlining the section 207(a) performance warranty was updated in 1987. It will be printed and made available to State and local programs. Other related actions include preliminary work on clarifying section 207(a) regulations and a national warranty awareness campaign.

H. IMPORTS

The control of emissions from imported vehicles has become a major issue in recent years. Due to the desire for luxury imported cars and the strong dollar throughout most of this decade, the importation of cars which do not conform to applicable air pollution control regulations increased from 1,500 in 1980 to a high of 68,000 in 1985. In 1987, EPA received 20,000 applications and 29,000 inquiries concerning these automobiles. The EPA believes the decrease in imports from its 1985 peak is largely attributed to the dollar's decline in exchange value in foreign markets, rather than a change in consumer taste. The EPA has substantially automated the processing of applications and test data for cars which have been modified for compliance with emission standards. In 1987, EPA promulgated a final rule updating its regulations controlling these automobiles.[6] Under these revised rules, the vast bulk of these imported vehicles will be allowed to enter the U.S. via EPA's new vehicle certification program. The new procedures will increase EPA's confidence that the vehicles have been properly designed to assure continued satisfactory in-use emission performance.

The EPA has also been investigating various laboratories to ensure that nonconforming imports have been tested properly to demonstrate conformity with U.S. emissions standards. These laboratories are required to conduct a Federal test procedure and submit the results to EPA for approval. Some laboratories, however, have been falsifying the results of these tests. In 1987, EPA successfully prosecuted five laboratories resulting in 27 individual convictions and one corporate conviction. The EPA took administrative action against two additional laboratories.

I. LITIGATION

Fuels Enforcement

On June 30, 1987, a U. S. District Court in New York City imposed a judgment for $180,000 against a corporation for a violation of section 211 of he Clean Air Act. The case is significant since it is the second time a [illegible] District Court awarded per-day penalties for each and every day of the continuance of the violation.

Lead Phasedown

Enforcement of lead phasedown has resulted in criminal prosecution of individuals. At least two criminal cases are now pending which were developed in the course of EPA investigations. The EPA attorneys are participating in the prosecution of these cases in conjunction with the environmental crimes unit of the U.S. Department of Justice. Other more egregious cases, including four related cases with potential penalties of $40 million, are pending. The EPA has also issued notices to 18 refiners or importers proposing a total of $24 million in civil penalties. The parties were cited for failure to file quarterly reports, overuse of lead in gasoline production or the illegal creation of lead usage rights (banking violation).

Tampering

In 1986, EPA, in separate violation notices, cited 16 repair facilities in Indiana, New York, and Colorado for Clean Air Act tampering violations by allegedly removing catalytic converters from 33 vehicles so that converter replacement pipes could be installed. The EPA also cited the manufacturer of the replacement pipes for "causing" the violations. In 1987, a $75,000 settlement was reached with one of the nation's largest manufacturers of catalytic converter replacement pipes. The manufacturer is also prohibited from any further marketing of the devices. The EPA worked with the State of Indiana to resolve this and related cases against parts distributors who sold the devices and repair facilities who installed them on vehicles. The State cases also involved a large number of catalyst replacements as a condition of settlement and the collection of substantial penalties against the distributors and installers as well. Investigations of all other major manufacturers of catalytic converter replacement devices known to EPA are ongoing. The first year EPA settled cases based on the "causing" language of section 203 of the Clean Air Act was 1987.

J. REFERENCES

1. 52 FR 31274, August 19, 1987.

2. 52 FR 31162, August 19, 1987.

3. 53 FR 470, January 7, 1988.

4. 52 FR 21075, June 4, 1987.

5. 52 FR 924, January 9, 1987.

6. 52 FR 36136, September 25, 1987.

X. STRATOSPHERIC OZONE PROTECTION

A. DESCRIPTION OF ACTIVITIES

On December 14, 1987, EPA proposed regulations[1] to implement the Montreal Protocol on Substances that Deplete the Ozone Layer, which was signed by 24 nations in September 1987. Currently, 30 nations including all the major chlorofluorocarbon (CFC) producers have signed the Protocol. This landmark environmental agreement calls for a 50 percent reduction in use of CFC's and a freeze on use of halons over the next ten years. By reducing the future use and emissions of CFC's and halons, these restrictions will help protect the earth's stratospheric ozone layer.

The EPA proposed to limit the production and consumption of certain CFC's and halons to reduce the risks of stratospheric ozone depletion. Specifically, the proposal requires a freeze at 1986 consumption and production levels of CFC-11, -12, -113, -114, and -115 on the basis of their relative ozone depletion weights, followed by reductions up to 80 percent and 50 percent of 1986 levels beginning in mid-1993 and mid-1998, respectively. It would also prohibit production and consumption of Halon 1211, 1301, and 2402 from exceeding 1986 levels on a weighted basis beginning in approximately 1992. Under limited circumstances, somewhat higher levels of production (but not consumption) would be permitted. Consumption is defined in the rule as production plus imports minus exports of the bulk chemicals as listed above.

The EPA proposed that quotas reflecting the allowable level of production and consumption be allocated to each of the firms that engaged in these activities in 1986. As alternatives and supplements to this approach, EPA is evaluating and has requested comments on other control mechanisms such as regulatory fees and auctioning of production rights.

The EPA proposed its regulations pursuant to section 157(b) of the Clean Air Act. This proposal constitutes the United States' implementation of the Montreal Protocol. The EPA proposed that the control requirements listed above only take effect if the United States ratifies the Protocol and following its entry into force. The Protocol is expected to enter into force on January 11, 1989, following ratification by 11 nations representing two-thirds of global consumption. United States ratification occurred in April 1988.

The EPA's proposed action was in response to growing scientific evidence linking increased atmospheric levels of chlorine and bromine to anticipated depletion of the ozone layer. If ozone depletion occurs, increased levels of harmful ultraviolet radiation would penetrate to the earth's surface, resulting in substantial damage to human health and the environment. In the thirteen years since concern about CFC's and ozone depletion was first raised, substantial scientific research has supported the general conclusion that concentrations of chlorine, as well as from bromine from halons, in the stratosphere pose substantial risks of depletion.

Two extensive assessments of stratospheric risks were completed and relied upon by EPA in evaluating the need for additional restrictions on the use of potential ozone-depleting chemicals. The first, Atmospheric Ozone 1985[2] provides an extensive review of the current state of knowledge concerning atmospheric chemistry and modeling, past changes in trace gases that affect ozone levels, and current trends in ozone levels. A second study, An Assessment of the Risks from Trace Gases that can Modify the Stratosphere[3] was prepared by the EPA and reviewed by its Science Advisory Board. This study summarizes the state of knowledge related to both atmospheric issues (e.g., possible future changes in ozone levels) and human health and environmental effects if the ozone layer were depleted.

B. REFERENCES

1. 52 FR 47489, December 14, 1987.

2. Atmospheric Ozone - Assessment of Our Understanding of the Processes Controlling Its Present Distribution and Change, Work Meteorological Organization (3 Volumes), 1986.

3. EPA 400/1-87/001.

XI. RADON ASSESSMENT AND REMEDIATION

Radon is a radioactive gas produced by the decay of uranium, which occurs naturally in soils and rocks. The EPA estimates that indoor exposure to radon may cause 5,000 to 20,000 lung cancer deaths each year. A recent report of the National Academy of Sciences identified radon as a serious national public health issue, and confirmed EPA risk estimates.

The EPA's Radon Action Program's initial efforts in 1985 were concentrated in the Reading Prong area of Pennsylvania, New Jersey, and New York where elevated levels of indoor radon were first discovered in homes. The EPA provided these States with assistance in radon measurement and mitigation of radon exposure in affected homes. Since then, high radon levels have been found in nearly every State. Program activities were expanded in 1986 and 1987 in response to the growing scope and complexity of the radon problem.

The goal of EPA's Radon Action Program is to significantly reduce the health risks of radon through a partnership with other Federal agencies and the States. To accomplish this goal, EPA is developing and disseminating technical knowledge to encourage, support, and facilitate the development of State programs and private sector capabilities. The program has four major elements:

1) Problem Assessment - To identify areas with high radon levels in houses and to determine the national distribution of radon levels and associated health risks.

2) Mitigation and Prevention - To identify cost-effective methods to reduce radon levels in existing structures and to prevent elevated radon levels in new construction.

3) Capability Development - To stimulate the development of State and private sector capabilities to assess radon problems in homes and to help people mitigate such problems.

4) Public Information - To work with States to provide information to homeowners on radon, its risks, and what can be done to reduce those risks.

The EPA's accomplishments in these areas during 1987 include the following:

Problem Assessment

- Standardized measurement protocols for seven measurement methods were issued to help ensure that radon measurements are comparable and accurate.

- Assistance was provided to ten States in designing and conducting surveys to identify areas where indoor radon may be a problem. The EPA is assisting seven additional States and numerous Indian Nations with similar surveys in 1988.

- Identification of geological factors and characteristics which are useful as indicators of areas with high radon levels was begun.

- The use of soil gas measurements to predict radon problems on potential building sites was investigated.

- Research and design for a national assessment of radon in homes, schools and occupational settings was begun in order to characterize indoor radon levels across the United States. This national assessment is required by the 1986 Superfund Amendments and Reauthorization Act (SARA).

Mitigation and Prevention

- The House Evaluation Program (HEP) was established in order to assist States in evaluating and mitigating radon exposure in houses discovered to have elevated radon levels. The HEP has provided "hands-on" training to officials from New York, Virginia, Pennsylvania, New Jersey, Tennessee, Ohio, the National Park Service, and the Seneca Indian Nation in evaluating and mitigating radon exposure in 80 selected houses in their respective areas.

- The EPA cooperated with the National Association of Homebuilders and private homebuilders to develop, demonstrate, and release interim guidance for preventing radon in new construction.

- The EPA worked with model building codes organizations to begin the process of incorporating radon prevention techniques into national building codes.

- Research and operational programs were begun in order to expand mitigation and prevention activities into schools and workplaces.

- Selected radon exposure mitigation techniques were researched and demonstrated in houses in the Reading Prong. Sixty-four houses have been completed and the program has been expanded into Maryland, Tennessee, Alabama, and Florida.

Capability Development

- A technical training course on radon diagnostics and mitigation techniques was developed for States and private contractors. Twenty-nine courses were conducted and 1,500 participants from 40 States were trained. To meet with growing demand, a video tape of the course was produced and distributed through Regional Offices for use by all fifty States.

- The Radon Measurement Proficiency Program was established in order to allow private firms and other organizations to demonstrate their proficiency in measuring radon. When the program began in 1986, 35 companies participated; by the end of 1987, the list of participants had grown to over 350.

Public Information

- Five radon brochures were developed and distributed:

  "A Citizen's Guide To Radon: What It Is and What To Do About It;"
  "Radon Reduction Methods: A Homeowner's Guide;"
  "Removal of Radon from Household Water;"
  "Radon Reduction in New Construction: An Interim Guide;" and,
  "Radon Reference Manual."

- In addition, EPA participated in many national conferences and workshops on indoor radon, provided information and interviews to the media, organized and conducted press conferences and briefings on radon issues, and responded to thousands of public inquiries regarding indoor radon exposure.

While much of EPA's activity was initially directed at States in the Reading Prong area, the Radon Action Program is now assisting States throughout the country. Technical assistance activities will continue as an increasing number of States, Indian Nations and Federal agencies work to identify and address radon exposure problems. The EPA will also continue to expand its technical assistance capabilities in response to the increasing complexity of the radon problem.

XII. LITIGATION

A. INTRODUCTION

During 1987, two significant precedent-setting cases involving the Clean Air Act (Act) were decided in the courts and are discussed below. Following those cases is a discussion of a number of others with important implications, but which are not as broadly significant.

B. LANDMARK DECISIONS

1. Hazardous Air Pollution Decision: NRDC v. Thomas

In a major ruling on EPA's obligations under section 112 of the Clean Air Act, the entire D.C. Circuit held that while consideration of costs and feasibility in standard setting on hazardous air pollutants is not precluded for purposes of setting standards, EPA must first determine a level representing an "acceptable risk." The court also concluded that section 112 does not require elimination of all risk, but that EPA should follow a process under which a decision is first made on a level representing an "acceptable risk" for a pollutant, followed by a second step in which cost and feasibility could be considered in providing an "ample margin of safety." The decision of the court modified a previous panel decision in the same case, issued in 1986, that upheld EPA's approach in all respects.

2. Ozone and Carbon Monoxide Nonattainment: Abramowitz v. EPA

In a case of great significance to EPA's program for areas with serious nonattainment problems, the Ninth Circuit overturned EPA's partial approval of ozone and carbon monoxide State implementation plans (SIP's) for California's South Coast air basin, and ordered EPA to disapprove those SIP's for failure to meet the statutory requirements for attainment by December 31, 1987. The EPA had initially approved the control measures in the SIP, but withheld approval or disapproval as to attainment. The court held that the Act does not authorize EPA to approve control measures independent of a determination on whether the SIP demonstrates attainment.

C. OTHER SIGNIFICANT DECISIONS

1. Attainment Deadlines

Following the inability of many areas of the country to attain national ambient air quality standards (NAAQS) by the deadline established by the Act, a number of lawsuits have been filed to force State and Federal agencies to revise, implement, or promulgate SIP's. In addition to the Abramowitz decision discussed above, three others were decided in 1987.

Natural Resources Defense Council (NRDC) v. New York State Department of Environmental Conservation was a citizens suit against the State of New York and EPA by NRDC to compel the State to carry out portions of its previously approved ozone and carbon monoxide SIPs and to require a new SIP in light of anticipated failure to attain by the December 1987 attainment deadline specified in the Act. The district court held that the plaintiffs were entitled to a finding of liability regardless of the State's reasons for failing to carry out its obligations, and ordered the State to promulgate certain regulations, including those addressing installation of gasoline vapor recovery devices on service station pumps.

American Lung Association of New Jersey v. Kean involved a citizens suit to force New Jersey to implement nine ozone reduction strategies that the State had neglected to carry out. The court rejected the State's good faith intentions, and interpreted New Jersey's 1983 SIP submission as binding, judging that any ambiguities in the SIP would properly be construed against the creator of the SIP--the State itself.

Wilder v. Thomas was a case in which the court dismissed a citizens suit complaint seeking to halt the Times Square Redevelopment Project in Manhattan, based on air pollution impacts from increased commercial activity and vehicular traffic, arguing that construction of the project would assure carbon monoxide nonattainment beyond the statutory deadline. The court held that the failure of the SIP to attain the national standard was not, in and of itself, a violation of a condition or requirement of a SIP, or otherwise actionable under the citizens suit provision of the Act.

2. SIP Approval: Concerned Citizens of Bridgesburg v. EPA

Two citizens groups challenged an EPA final decision that emissions of offensive odors are not separately regulable under section 110 after EPA disapproved odor regulations contained in the Pennsylvania SIP. The citizens groups contended that EPA should have followed the revisions procedure under section 110(c) and provided Pennsylvania with reasonable notice and hearing prior to disapproving. The Third Circuit held that any modification of a SIP constitutes a "revision," which can be accomplished only through the statutory procedures.

3. SIP Disapproval and Sanctions: Arizona v. Thomas (two cases)

In one decision, the Ninth Circuit upheld EPA's disapproval of an Arizona SIP revision for total suspended particulates and new source review, and imposition of a construction ban against a challenge by the State. Arizona had argued that: (1) in 1984 EPA proposed a revised standard for particulate matter and, consequently, deferred issuing SIP calls for other TSP SIP's, and (2) as a result, EPA, by disapproving Arizona's SIP revision and imposing the construction ban, unfairly singled out Arizona for harsher treatment than imposed on other States. The court rejected the argument, explaining that the State had not shown it was subject to harsher treatment than any other similarly situated State.

In a second decision, the Ninth Circuit also upheld EPA's decisions to disapprove Arizona's carbon monoxide SIP's for the Tucson and Phoenix areas, and to impose construction bans. In challenging the disapprovals, the State argued that because EPA had previously approved the SIP's as providing for attainment by 1982, its action should have been merely to issue a SIP call, not to disapprove and impose a ban. The court agreed with EPA that EPA and Arizona had both recognized before disapproval that the prior SIP's did not provide for attainment, and that EPA had properly imposed the ban.

4. Prevention of Significant Deterioration: Sierra Club v. Thomas (two cases)

One case was a citizens suit to compel EPA to issue regulations to prevent significant deterioration of air quality from emissions of nitrogen oxides. The EPA admitted it had failed to issue such regulations as required by the Act and the opinion focused on how fast EPA should be required to act. The court imposed a deadline equivalent to the amount of time Congress originally allotted to EPA for taking the action, and rejected EPA's claim that the task could not be accomplished in that time.

In the second case, the D.C. Circuit dismissed a petition seeking to require EPA to complete rulemaking on whether strip mines should be subject to regulations governing fugitive dust. The court judged that a three year delay since issuance of proposed rules was not unreasonable under the circumstances, recognizing that while agencies have a duty to avoid unreasonable delay, courts should be hesitant to upset an agency's priorities.

5. Section 211: Regulation of Fuels

In Union Oil Co. v. EPA, the D.C. Circuit rejected a challenge to lead "banking" regulations under the lead phasedown program. In 1985, EPA imposed phased reductions on the lead content of gasoline, including allowance of "banking" of credits for reductions below required levels. This permitted refiners to "bank" credits for the difference, and to use or trade them with others to offset lead usage exceeding the current limits.

6. Enforcement

In decisions involving State implementation plans, two circuit courts held that EPA can enforce a current SIP while a source owner is trying to change the regulation. In United States v. Ford Motor Co., the Sixth Circuit held that the current federally-approved standard could be enforced even though Ford and the State of Michigan had entered a consent judgment in State court invalidating the regulation. The court viewed Michigan's act as modification of the SIP based on revised notions of technological and economic feasibility, but held that EPA had the final say on modifying the SIP. In a second decision, the Third Circuit also held that Federal enforcement of an existing SIP could proceed in United States v. Wheeling-Pittsburgh Steel Corp. In this case, the company had submitted an emissions trading ("bubble") proposal to the West Virginia agency, but the proposal had not been formally submitted to EPA. The Circuit concluded that the district court erred in relying on the bubble as a basis for ordering modification of the existing consent decree.

In American Cyanamid Co. v. EPA, a case which involved noncompliance penalties, the Fifth Circuit held that EPA could not collect administrative penalties until it rejected a State proposal that would have brought the company into compliance. The court found that EPA must act on a proposed SIP revision within the four month period specified in section 110(a)(2) of the Act.